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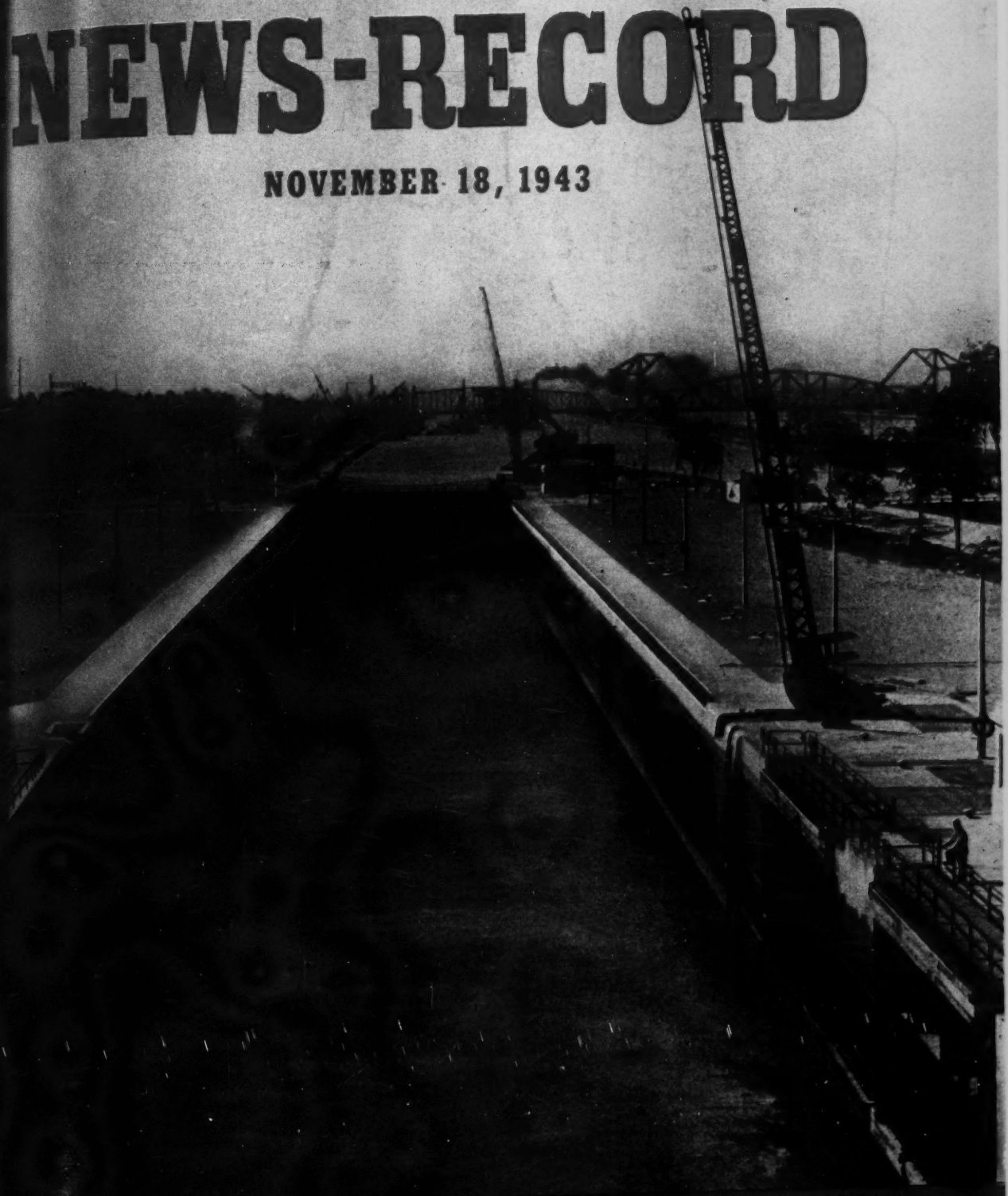
ENGINEERING NEWS-RECORD

NOVEMBER 18, 1943



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Meanwhile, can we assist wi your drainage problems? The a swer may be in the use of non-st tegic materials, or in suggestions f repairing and salvaging older str tures. Write to us for informatio Armco Drainage Products Assoc tion, 15 Curtis St., Middletown,

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Vol. 131 NOVEMBER 18, 1943 No. 21

COMING NEXT

• That big bridge construction methods can be adapted successfully to the assembly of all-welded ships has been proven at a southern Indiana shipyard. This yard was designed and is being operated jointly by five old line heavy construction companies. It was laid out for fast production-line assembly of tank-landing craft. The yard plan and assembly methods will be described in *ENR* for Dec. 2.

• The installation of several miles of 12-in. wrought iron pipe for a permanent submarine water supply main in tidal waters off the coast of Maine—at some places more than 120 ft. deep—presented many unusual and difficult problems. A tidal variation of 10 ft. and low temperatures of a record-breaking winter added to the complications. The job will be described by the project engineer in the Dec. 2 issue.

• Organization, teamwork and the right type of equipment generally produces record-breaking construction. Such was the case on a recent timber blimp dock for the Navy. This arch barrel structure of 237-ft. span, 170 ft. high and 1,000 ft. long, was erected in 156 hours, complete with all facilities. A two derrick traveler that lifted arch segments two ribs wide was used. See *ENR*'s Dec. 2 issue.

LOOKING AHEAD

• Although the method of moment distribution developed by Prof. Hardy Cross has become very popular in this country for analyzing indeterminate structures, the use of the end rotation constant has been largely overlooked, as few designers take full advantage of these convenient factors. Milton W. Rosenstein, Chicago structural engineer, has prepared an article on this subject for early publication.

• A procedure for making field load bearing tests that is believed to be simpler, faster and less costly than those now in common use has been developed at Fort Dix, N. J. Only three hours is required to set up the equipment and make a test. An article describing this new development is scheduled for mid-December.

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Director of Circulation:
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From .....

To .....

Signed .....

ROAD SCALING CONTROLLED WITH ATLAS "DURAPLASTIC"*

Air-Entraining Portland Cement

Universal Atlas test road at Hudson, N. Y., installed in 1938, where the scale-resistant properties of concrete made with Atlas Duraplastic *air-entraining portland cement were first demonstrated under service conditions.*

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1. **Complies** with current Federal and ASTM specifications.
2. **Renders** concrete pavements highly resistant to scaling due to the action of salts used for ice removal.
3. **Protects** concrete against the effects of freezing and thawing weather.
4. **Minimizes** segregation and bleeding. Concrete is more uniform throughout and more durable.
5. **Permits** earlier finishing.
6. **Requires** no additional materials at the mixer.
7. **Called *DURAPLASTIC*** because it makes concrete more *durable* and more *plastic*.

Atlas *Duraplastic* portland cement is a development of more than five years of research and testing by Universal Atlas in the laboratory, in the plant, and on the job.

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After 60 cycles of freezing and thawing, and 60 heavy applications of calcium chloride—equivalent to many winters of actual service—the sections made with *Duraplastic* air-entraining portland cement remained 97% scale free, exceeding all others in their resistance to weather and de-icing exposure.

Since then air-entraining portland cement has been used in more than a score of installations for streets and highways in over a dozen states.

Duraplastic is a true portland cement in which a small, precise amount of the air-entraining material is interground during manufacture, in accordance with current Federal and ASTM specifications. It has all the properties which have made portland cement the favorite paving material, and, in addition, renders concrete highly resistant to frost and salt action. Its use involves practically no changes in methods of laying concrete paving.

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ENR-D-2

For Scale-Resistant Paving

ATLAS DURAPLASTIC

Air-Entraining Portland Cement

The Week In Engineering and Construction

GINEERING NEWS-RECORD • NOVEMBER 18, 1943 • VOLUME 131 • NUMBER 21

New local highway agency proposed in Congress

Creation of a Rural Local Roads Administration independent of the Public Roads Administration is provided for in a bill to aid county road work.

bill has been introduced in Congress ch would set up within the Federal ks Agency a separate administration e known as the Rural Local Roads inistration, and which would author- $1,125,000,000 solely for the construc- of rural "all-weather type" roads. order that the county viewpoint may assured in the proposed new roads inistration, the bill provides for an inistrator with not less than ten years erience as a county highway engineer, e appointed by the President, at a ry of $9,000.

he bill, designated as S. 1498, was oduced by Senator Stewart of Ten- see, who points out that the proposed slation originated among county high- divisions in that state, which seek to ive direct federal aid without having manner in which they use that federal specified by state highway authorities, in the past. Heretofore, secondary ds have been built, either by local horities with their own or WPA funds, the state with federal-aid funds or state motor-fuel or other funds. ce Congressional authorization in 3, the federal government has pro- d for federal-aid for secondary roads mounts totaling $496,000,000, includ- emergency funds, such as National overy funds and Emergency Relief funds.

Joint engineering staffs

ot all of the 3,100 counties in the ntry have engineering staffs, hence the bill provides that several counties cooperate in order to maintain a lified highway department.

hereas the new bill authorizes ap- priation of $1,125,000,000 for rural ds, including those through cities of more than 5,000 population, to be inistered by the proposed Rural al Roads Administration, another bill awaiting Congressional action is 71, sponsored by the American Asso- ion of State Highway Officials and understood to have the endorsement of the Public Roads Administration, which authorizes 3 billion dollars to be divided equally between federal-aid and secondary roads. This money can be employed to defray the cost of projects on a 75-25 basis instead of the more orthodox 50-50 division between the states and the federal government (*ENR*, July 29, p. 179).

Under this latter act, apportionment of funds would be based one-half on population, one-fourth on area, and one-fourth on post-road mileage, while the bill proposing a separate Rural Local Roads Administration places the emphasis on mileage, since it apportions funds on a basis of 50 percent mileage, 30 percent population, and 20 percent area. Mileage in the latter bill is designated as that "used for rural mail delivery, 'star' routes, or school bus service," and is limited to 10 percent of the total mileage of the highway system of each particular jurisdiction. The rural local system excludes all roads on a state highway system.

No funds until after the war

Under both bills, the money becomes available in three equal, annual allotments, but the first installment is not to be paid until after the war is over. This limitation appears to cover planning and acquisition of rights-of-way as well as the costs of construction, but both bills say that the commissioner "is authorized to enter into agreements with state highway departments for the making of surveys and plans and the acquisition of rights-of-way." Both add that "his approval of any such agreement shall be a contractual obligation of the federal government for the payment of its pro rata share of the cost thereof when the funds provided herein are made available for construction." Hence, it is apparent that highway departments under both bills would have to use their own funds for advance road planning work.

British Combine-photo

Building a military road in Italy

Various types of surfacing mats are now accepted practice in emergency road construction. Here British engineers of the 8th Army are shown pegging down "army track" on a new road cleared to avoid a blockaded section of the old road. This particular type of mat is essentially heavy wire mesh reinforced with steel rods.

Construction industry can help avoid need for a national service act

Voluntary, cooperative action in every industry and area is required, National Labor-Management Policy Committee says, in urging construction workers to continue in their own line of activity.

Plans for the part the construction industry is to play in the efforts now being made to avoid a national service act were made public in Washington following the announcement of the National Labor-Management Policy Committee that it is working to make such an act unnecessary. The committee, on which industry, management and labor are represented, was set up last July when Paul V. McNutt, head of the War Manpower Commission, asked for a report from representatives of labor and industry what form a national service act should take if one became necessary. Instead of reporting on possible legislation, the committee, on Nov. 6, gave Mr. McNutt its pledge to "strive vigorously and exhaust every possibility to solve the nation's manpower problems through voluntary, cooperative action in every industry and every area."

The plan for the construction industry, which it is understood is being developed by Joseph Keenan, vice chairman of labor relations for the War Production Board, is intended to stimulate use of contracts for all types of major industrial repair work and for plant conversions, which are now done partly by the contract method and partly by individual hiring by plant management. It is believed that far greater use can be made of the contractor method for such work as carpentering, painting, and other trades work, particularly in the mechanical trades, such as electrical, heating, piping, and plumbing.

One of the main problems has been to overcome the wage discrepancy between the construction trades and the production industry, but it is said that labor is willing to make the necessary adjustment by foregoing the somewhat higher wages which it normally gets in construction, over what is paid by the production industry.

It is pointed out that by continuing in their own line of work, construction workers will aid the war effort and at the same time will help keep the construction industry itself functioning in its natural capacity, and thus be in a position to go forward at full speed when the private building and public works programs develop after the war. Under a national service act, construction laborers could be forced out of their own trade and into a line of work quite foreign to them.

WPB halts construction on two aluminum plants

The War Production Board has given a 10-day notice for contractors to halt work on two major aluminum extrusion plants whose estimated cost totalled $37 million. The plants were authorized last May and though ground has been broken, little, if any, actual construction work has been done.

One plant, to cost $20 million, was for the Reynolds Metals Co. at Memphis, Tenn., and the other, at a cost of $17 million ,had been started at Columbus, Neb., for the American Brass Co. of Waterbury, Conn. Contracts for the latter was let in October and for the Memphis plant in late August.

Under the revocations, all preference ratings assigned builders and suppliers are invalidated. Ratings assigned to machinery and equipment may be revoked at the discretion of WPB's aluminum and magnesium division. Machinery and equipment completed can be utilized for maintenance and replacement in extrusion plants already in operation. The reason for revoking construction orders is that since the plants were originally authorized six months ago, present facilities have been found adequate to meet production needs.

Contract for construction of the plant at Memphis is held by the Struck Construction Co. of Louisville, Ky. The contract for the Columbus, Neb., plant went to Peter Kiewit Sons Co. of Omaha, Neb.

. . .

Alaskan highway buses now operate to Fairbanks

The farthest north through-bus service in the world was put in operation last week as buses chartered by the American Army began rolling into Fairbanks on the Alaska highway.

For the last three months the buses have been plying between Dawson Creek, British Columbia, the southern terminus of the international road, and Whitehorse, in the Yukon Territory. This stretch covers about 1,000 miles. Whitehorse is the main base and the headquarters of Brig. Gen. James A. O'Connor's Northwest Service Command.

So far, travel on the Alaska highway buses is confined to military personnel, civilian construction workers and others associated with the war effort.

Pollution research board sought in House bill

Representative William A. Rowan of Illinois has introduced in the House of Representatives a bill providing for establishment of a Water Pollution Control and Sewage Utilization Board, whose duty it would be to choose various universities of the country to carry on research "for eliminating or reducing the pollution, and improving the sanitary condition of the waters of the United States and for the treatment of sewage and industrial waste," in order that such waste may be utilized to the greatest possible extent as a fertilizer.

The board would consist of three members, including the Secretary of Agriculture, the Surgeon General of Public Health, and a third member to be chosen by the first two. The board would operate outside of civil service and would be empowered to engage sanitary, bacteriological and chemical engineers, and research, clerical, and other assistants. It would function for an undetermined number of years. The bill also authorizes appropriation of sums of money which, however, are not specified.

The universities at which research was carried on would report to the board from time to time; and the board, in turn, would recommend legislation to Congress.

Since neither the Department of Agriculture nor the Public Health Service has been instrumental in creating the bill, and since Mr. Rowan comes from Illinois, it may be supposed that his purpose is closely connected with the problem of pollution of Lake Michigan.

. . .

More bids received for Chicago filtration plant

Another step was taken toward the completion of Chicago's South Side filtration plant, Nov. 8, when the city engineering department received bids for a large part of the electrical work to be installed in the low-lift pumping station and the chemical building at that plant, according to Oscar E. Hewitt, commissioner of public works. Work on the superstructure of these buildings, located at 79th St. and Lake Michigan, was started last August (*ENR*, Sept. 2, p. 361).

There was a total of nine bids submitted, ranging from a low of $219,900 offered by the Harmon Electric Co. of Chicago, to a high of $329,200. Separate unit prices were received on 117 items covering such a wide range of work as to require 130 pages of specifications.

Plans call for completion of the plant sufficiently to coagulate and settle water for use by the city's South Side residents some time next year.

Portland, Ore., consultants submit postwar program

The suggested postwar construction nd development program for Portland, re., prepared by Robert Moses, com-issioner of the Department of Parks f New York City at the request of five ax-levying agencies in Portland (*ENR*, ept. 9, p. 70) was laid before them on ov. 9.

The plan, now being considered by the ortland School Board, the City Council, e Port Commission, the Dock Commis-ion, and the Multnomah County Board f Commissioners, is for two years and alls for the expenditure of $60,000,000 or construction and $15,000,000 for the cquisition of private lands for public se.

The highlights of the program include:

Construction of a new bridge across the Willamette River in downtown Portland.

Construction of a new inter-State bridge etween Portland and Vancouver, Wash., and reation of a bi-State bridge authority similar the Triborough Bridge Authority of New ork.

Construction of a complete new system of thruways" which would encircle but not nter the downtown business district.

Relocation of the upper Columbia River ighway on a "water" level.

Development of a $10,350,000 sewage dis-osal plant aimed at ridding the Willamette iver of pollution.

Construction of six grade school buildings nd one high school building.

Development of a twenty-four-block civic enter around the existing Portland City all, Multnomah County Court House and nited States Court House.

Construction of new union railroad station nd bus depot surrounded by an eleven-block laza.

Widening of Portland's narrow streets and lanting of trees along many of them.

Development of scenic drives around the ty limits.

Completion of a short Portland-to-the-sea ighway started before the war.

Improvement of Portland's park and play-round facilities.

Construction of a new building to house ortland's central police headquarters, city il and municipal courts.

Portland is one of the nation's war-oom towns, principally because three of e Kaiser shipbuilding plants are in the rea and employ 90,000 persons. Com-ared with a prewar population of about 0,000, the Portland metropolitan region ow has a population of nearly 700,000.

The report estimates that 67,000 per-ons in the region will be without jobs hen the war ends, and that as many as ,000 returning service men will also be eeking employment. About half of the 7,000 will return to their prewar homes nd probably half of the remainder will ave to seek jobs elsewhere, the report ays. This would bring the labor pool own to the 20,000 persons envisioned in e plan as needing postwar jobs.

To finance design work on the projects in the program, Mr. Moses urged an immediate $800,000 bond issue. As to financing the construction work, Mr. Moses is reported to have suggested that there is a good chance of federal aid up to 50 percent of the cost.

• • •

Brooklyn Bridge transit removal allowed by WPB

On Nov. 13 the War Production Board granted to the New York City Board of Transportation permission to resume elimination of rapid transit lines from the Brooklyn Bridge. The decision canceled its Oct. 5 revocation of the project.

The WPB had revoked permission for the $970,000 undertaking because of inability to obtain assurance from the Board of Transportation that the salvaged steel was to be used entirely for scrap, it appearing at the time that some of it was to be used for other purposes.

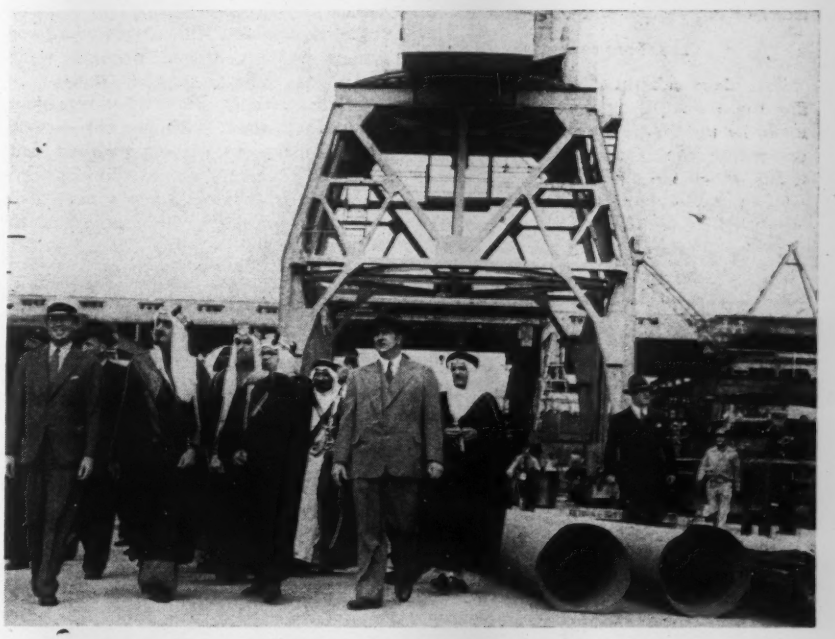
The project is expected to yield about 7,300 tons of high-grade steel scrap for war purposes.

Extra truck tire care urged by rubber director

In a Nov. 10 report, Bradley Dewey, rubber director, said that "up to the present time no synthetics are being used in most sizes of truck tires over 10.50 in size, in earth mover, rock service, logger tires, mud and snow tires 18.00 and larger," and in other named types. Some of the products mentioned above will have synthetic rubber added after January first, Mr. Dewey added.

He also pointed out that "truck tire rationing is based on the use of the vehicle rather than on mileage. Tires are issued only to those vehicles used for purposes essential to the war effort or essential to the health and safety of the public."

Truck tires, he said, without distinguishing one size or type from another, are one of the serious problems facing the country today. "New tires cannot be produced in sufficient quantity in the immediate future to prevent an extension of the present shortage," he declared, and called upon tire users to use their tires with care.



Arabian Royalty finds oil tanker construction interesting

Representing a nation whose undeveloped oil resources are believed to be the largest in the world, two princes of the royal family of Saudi Arabia recently visited the Marinship yard at Sausalito, Calif., to inspect the 16,500-ton tankers under construction there. The presence of the princes in this country at this particular time, when development of Middle East oil resources is much in the news, has led to much speculation and many rumors, one of the latter being that a large contract is being drawn up with an American construction firm for work in Saudi Arabia. The California-Arabian Standard Oil Co., a combination that includes Standard of California and Texas Corp., holds extensive oil rights in Saudi Arabia granted it by King Ibn Saud, father of the visiting princes.

From left to right in the above view are W. E. Waste, general manager, Marinship; Prince Amir Faisal; Prince Amir Khalid; Shaikh Hatiz Wahba, official interpreter; S. D. Bechtel, vice president, Marinship; and Abdulla Balkhair.

$8,000,000 flood control plan proposed for the French Broad River

Western North Carolina interests confer with TVA engineers regarding their survey just completed. Federal funds to be sought.

A proposed $8,210,000 flood control plan for the upper reaches of the French Broad River in Western North Carolina was approved by the area's leading industrialists and agriculturalists, and representatives, of railroads, interested state agencies and county flood control committees during recent conferences with the Tennessee Valley Authority engineers at Asheville, N. C.

The proposed project calls for seven detention dams and a levee on the Asheville, N. C., waterfront, and would affect five counties—Transylvania, Henderson, Buncombe, Haywood and Madison. North Carolina state agencies represented at the conferences just held with TVA engineers included the state industrial commission, the highway and public works commission, the department of agriculture, the department of conservation and development, the extension service, and the department of health.

The TVA survey

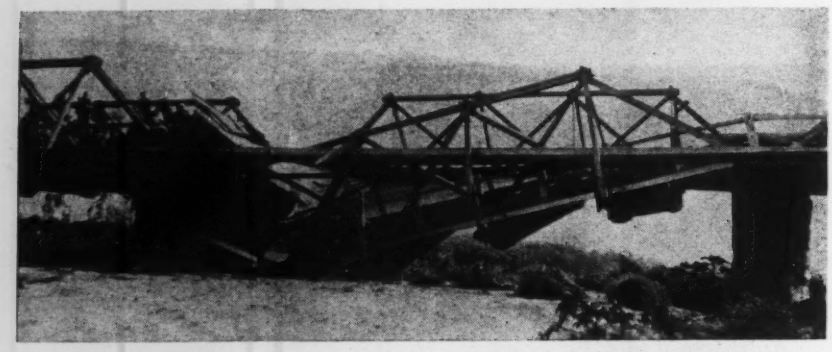
The plans submitted at the conference are the result of an exhaustive survey made by the TVA of ways and means of preventing the recurrence of damaging floods which have hit the French Broad River valley at intervals for years. As a result of the conference, it is expected that the Western North Carolina Flood Control Committee will request the executive committee of the TVA to apply formally for Federal funds for the project.

Attending the conference as representatives of the TVA were the following: James S. Bowman, chief water control planning engineer; A. S. Fry, head of the hydraulic data division; Van Court Hore, of the chief engineer's office; Frank Webster, head of the highway and railroad division; W. G. Stromquist, principal sanitary engineer with the health and safety department; Howard Menhenick, head of the regional studies division; E. G. Wisenhuegel, of the forestry relations division; and Hugh Powers, of the agricultural department.

Floods are costly

The TVA in reporting on its survey stated that "it is estimated that the floods which have occurred in the upper French Broad River basin during the past 65 years, if repeated with development conditions as they are at present, would cause total damages of $13,600,000.

Of this amount, 36 percent represents industrial damage, 28 percent agricultural damage, 14 percent railroad damage, and 6 percent damage to highways. Ten percent of the amount represents land and property devaluation in the industrial areas of Asheville and Biltmore."



Bridge wrecked by runaway trailer repaired in 5 days

Badly damaged when struck by a runaway trailer, a bridge over the Rio Hondo in Los Angeles County was reopened within five days by hard working crews of the California Division of Highways. The central span of the 19-year old timber structure collapsed under the impact which snapped an end post of the upstream truss and dropped one end of the truss 12 ft. to the stream bed. The downstream truss was subjected to severe lateral displacements but remained intact.

The collapsed span was jacked up to grade and the roadway repaired, allowing vital defense plant traffic to cross the structure. The complete repairing of the bridge was accomplished in about two weeks after the accident. Construction of a suitable temporary roadway around the crossing would have required a longer time and a greater expenditure.

The bridge is composed of eight 60-ft. Howe pony truss spans supported on pile bents. A 24-ft. roadway is provided.

Big tank floated 5 miles

When the Barbee Marine Yards, located the shores of Lake Washington at Seat recently moved across the lake, a 50,000-g water tank on an 83-ft. tower was mo bodily from the old to the new location. T job was accomplished by the Frank Ca Housemovers with the aid of a large tim barge on which the 75-ton tank and to were carefully loaded for the 5-mi. water t Prior to this move, tank and tower had be once dismantled and twice moved since first erection 20 yr. ago.

Over 700,000 war housi dwelling units complete

With the opening recently of nine five publicly financed war housing pr ects, a total of 691 have been comple during the first nine months of this ye the Federal Public Housing Autho has announced.

The total war housing program nanced with public funds, exclusive Home Owners Loan Corporation co versions, reached 716,286 dwelling un on Sept. 30. Of this number 535,5 were completed and under 51,575 h still to be placed under contract.

• • •

Rental-valuation fraud charged on two army jo

Indictments charging fraudulent rent and valuation of construction equipm used in the expansion of Fort Bra N. C., were returned Nov. 2 by a Fede grand jury against T. A. Loving & C a Goldsboro, N. C., construction in and two of its officers.

The grand jury also indicted th members of the Fayetteville, N. C., co struction firm of Grannis, Higgi Thompson & McDevitt on similar charg in connection with a contract for t construction of Camp Davis anti-air-cr school near Wilmington, N. C.

Construction Communiques

Engineering News from the Battlefronts

Treasury Islands—A good use for a bulldozer is described in this recent A. P. dispatch from Guadalcanal:

"An American bulldozer doubling in an emergency as an offensive weapon knocked out a Jap machine-gun nest during the landing on the Treasury Islands.

"A New Zealand officer, whose men were held up a few yards from shore by strong enemy machine-gun fire, saw an unidentified American drive his giant bulldozer from a landing craft which had just beached.

"With blade uplifted as a shield he charged through the undergrowth and then, as he reached the enemy pillbox, he dropped the blade, scooping up earth on the Japs and burying them. Halfway over the hole he swerved his improvised tank around and then pulled away leaving a flat, smooth area with no trace of the Japs or of the machine guns."

Italy—"Highway No. 36 is shown on no road map of Europe but it is a safe bet that it will be a permanent fixture from now on," says William H. Stoneman in a special radio message to The Chicago Daily News.

"Highway No. 36 connects two Italian valleys which have been separated since time immemorial by a rocky mountain rib which has defied even the splendid highway engineers who have flourished in Italy since the early days of Rome.

"It has not defied Maj. James O. Gibbons of Socorro, N. M., however, who is not interested in the historical aspect of his work. He and his gang of hard-working U. S. Army engineers manning the battery of bulldozers are interested only in carving a road through the mountain barrier so that our guns and supply trucks can get through to the neighborhood of Avellino.

"Highway 36 is perhaps the first major road of modern times which has not profited by the use of surveyors' instruments. The course of this meandering thoroughfare was chosen by Maj. Gibbons simply by walking up the mountainside, casting the eye of an old contractor over its jumble of gulleys and ridges, and ordering "Put her there!"

This road probably will remain for centuries as a monument to U. S. Army Engineers.

The Versatile Seabees—"If it is an impossible job, the Seabees will do it." That is how Admiral C. H. Woodward starts off an article in the "American Federationist." And, he continued, "That is the reputation the Seabees have won as a result of their exploits on the far-flung battlefronts of the world. They are the 'can do' men of the Navy, as much at home with a .45 as with a cement mixer.

"They have accomplished the seemingly impossible in all parts of the world, repairing damaged bases, constructing new advance bases. They run the gamut of all construction tasks, including the building of roads, air base runways, pontoon landings, bridges, hospitals, barracks, supply depots, hangars, living quarters, underground fuel tanks, sanitary facilities, docks, fortifications, evaporator plants, camouflaging—often under the most trying conditions."

Assam—American and Chinese engineering units, working with modern American trucks and road-building machinery and aided by gangs of Asiatic civilian laborers, are building the Ledo road that cuts into the Naga hills from Assam, India, toward the Japanese bases in northern Burma. It will pass through some of the world's densest forests and across successive ranges of mountains from 2,000 to 6,000 ft. high. Chinese troops are guarding the road, and, supplied from the air, they are staying well in advance of the construction work to keep the route clear of enemy interference.

Describing the work on this important road, Tillman Durdin says in the New York Times:

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Official Signal Corps photo

An American tamping roller flown to North Africa

One of the surprises sprung in this war by the U. S. Army was the transporting of construction equipment by planes. The idea was first used in the Tunisian campaign when, to the amazement of many of our own officers as well as those of our allies, huge transport planes swooped down on captured airfields, almost ahead of the advance troops, and unloaded graders, rollers, tractors and other equipment for the purpose of reconditioning and maintaining these fields for our planes.

Flying such equipment from one location to another permits temporary repairs, construction and maintenance at advance points, making airfields and other areas usable days and sometimes weeks before it would be possible to move in heavy construction equipment.

This airborne equipment is operated by the Aviation Engineers of the U. S. Army Air Forces. Pictured above is a tamping roller developed for the Aviation Engineers by J. D. Adams Company of Indianapolis, Ind. It is on a North African location being towed by a small crawler tractor.

$8,000,000 flood control plan proposed for the French Broad River

Western North Carolina interests confer with TVA engineers regarding their survey just completed. Federal funds to be sought.

A proposed $8,210,000 flood control plan for the upper reaches of the French Broad River in Western North Carolina was approved by the area's leading industrialists and agriculturalists, and representatives, of railroads, interested state agencies and county flood control committees during recent conferences with the Tennessee Valley Authority engineers at Asheville, N. C.

The proposed project calls for seven detention dams and a levee on the Asheville, N. C., waterfront, and would affect five counties—Transylvania, Henderson, Buncombe, Haywood and Madison. North Carolina state agencies represented at the conferences just held with TVA engineers included the state industrial commission, the highway and public works commission, the department of agriculture, the department of conservation and development, the extension service, and the department of health.

The TVA survey

The plans submitted at the conference are the result of an exhaustive survey made by the TVA of ways and means of preventing the recurrence of damaging floods which have hit the French Broad River valley at intervals for years. As a result of the conference, it is expected that the Western North Carolina Flood Control Committee will request the executive committee of the TVA to apply formally for Federal funds for the project.

Attending the conference as representatives of the TVA were the following: James S. Bowman, chief water control planning engineer; A. S. Fry, head of the hydraulic data division; Van Court Hore, of the chief engineer's office; Frank Webster, head of the highway and railroad division; W. G. Stromquist, principal sanitary engineer with the health and safety department; Howard Menhenick, head of the regional studies division; E. G. Wisenhuegel, of the forestry relations division; and Hugh Powers, of the agricultural department.

Floods are costly

The TVA in reporting on its survey stated that "it is estimated that the floods which have occurred in the upper French Broad River basin during the past 65 years, if repeated with development conditions as they are at present, would cause total damages of $13,600,000.

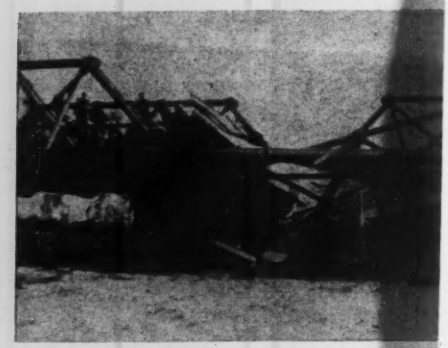
Of this amount, 36 percent represents industrial damage, 28 percent agricultural damage, 14 percent railroad damage, and 6 percent damage to highways. Ten percent of the amount represents land and property devaluation in the industrial areas of Asheville and Biltmore.

Big tank floated 5 miles

When the Barbee Marine Yards, located on the shores of Lake Washington at Seattle, recently moved across the lake, a 50,000-gal. water tank on an 83-ft. tower was moved bodily from the old to the new location. The job was accomplished by the Frank Cullen Housemovers with the aid of a large tug and barge on which the 75-ton tank and tower were carefully loaded for the 5-mi. water trip. Prior to this move, tank and tower had been once dismantled and twice moved since their first erection 20 yr. ago.

Over 700,000 war housing dwelling units complete

With the opening recently of nine five publicly financed war housing p



Bridge wrecked by runaway

Badly damaged when struck by a runaway trailer, a bridge over the Rio Hondo in Los Angeles County was reopened within five days by hard working crews of the California Division of Highways. The central span of the 19-year old timber structure collapsed under the impact which snapped an end post of the upstream truss and dropped one end of the truss 12 ft. to the stream bed. The downstream truss was subjected to severe lateral displacements but remained intact.

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Construction Communiques

Engineering News from the Battlefronts

Treasury Islands—A good use for a bulldozer is described in this recent A. P. dispatch from Guadalcanal:

"An American bulldozer doubling in an emergency as an offensive weapon knocked out a Jap machine-gun nest during the landing on the Treasury Islands.

"A New Zealand officer, whose men were held up a few yards from shore by strong enemy machine-gun fire, saw an unidentified American drive his giant bulldozer from a landing craft which had just beached.

"With blade uplifted as a shield he charged through the undergrowth and then, as he reached the enemy pillbox, he dropped the blade, scooping up earth on the Japs and burying them. Halfway over the hole he swerved his improvised tank around and then pulled away leaving a flat, smooth area with no trace of the Japs or of the machine guns."

Italy—"Highway No. 36 is shown on no road map of Europe but it is a safe bet that it will be a permanent fixture from now on," says William H. Stoneman in a special radio message to The Chicago Daily News.

"Highway No. 36 connects two Italian valleys which have been separated since time immemorial by a rocky mountain rib which has defied even the splendid highway engineers who have flourished in Italy since the early days of Rome.

"It has now defied Maj. James O. Gib-'can do' men of the Navy, as much at home with a .45 as with a cement mixer.

"They have accomplished the seemingly impossible in all parts of the world, repairing damaged bases, constructing new advance bases. They run the gamut of all construction tasks, including the building of roads, air base runways, pontoon landings, bridges, hospitals, barracks, supply depots, hangars, living quarters, underground fuel tanks, sanitary facilities, docks, fortifications, evaporator plants, camouflaging—often under the most trying conditions."

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JOBS OF THE WEEK

DWELLINGS, Middle River, Md.

Middle River Manor, Inc., New York, N. Y., awarded a contract for constructing 600 family dwellings, each 2 story, basement, to M. Shapiro & Sons, New York, N. Y. The estimated cost is $3,600,000. Alexander D. Crosett, New York, N. Y., is the engineer and architect.

NATURAL GAS LINE, Texas and West Virginia

Tennessee Gas & Transmission Co., Houston, Tex., awarded a contract for 612 miles of natural gas pipe line carrier from Corpus Christi to Edna, Tex., to Williams Brothers Corp., Tulsa, Okla., at an estimated cost of $13,000,000; 120 miles between Cleveland, Tex. and the Sabine River in Louisiana to Brown & Root, Inc., Corpus Christi, $2,500,000; 120 miles from Edna to Cleveland, Tex., to N. A. Saigh Construction Co., San Antonio, $2,400,000; 77 miles in Mississippi and line traversing Kentucky to Bechtel-Dempsey-Price, Houston, Tex., $7,500,000; furnishing 300 miles of 24-in. steel pipe to National Tube Co., Lorain, O., $3,275,000; seven compressor stations to Stearns-Roger Manufacturing Co., Denver, Colo., $1,600,000; twenty-seven compressors, each 1,000 hp., to Worthington Pump & Machinery Corp., Harrison, N. J.; and thirty-one compressors to Cooper-Bessmer Corp., Mount Vernon, O.

DWELLINGS, Houston, Texas

Frank W. Sharp Construction Co., Houston, Tex., will construct by its own forces and subcontracts 526 dwellings, including water, sewers, street improvements, to cost $1,500,000. H. H. Alexander, 4904 Laurel St., Houston, is the architect.

HOUSING, Akron, O.

A. P. Miller, Inc., Atlantic City, N. J., has been awarded a contract for 500 prefabricated temporary family dwelling units, by the Public Housing Authority, Cleveland, O., at $1,537,000. Akron Associated Architects, Akron, O., are the architects.

CONSTRUCTION, Texas

Peter Kiewit Sons Co., McDougal Construction Co. and Western Contracting Co., Sioux City, Ia., have been awarded a contract for construction at Air Forces installation, Dallas County. The estimated cost is $1,700,000. U. S. Engineers, Denison, Tex., awarded the contract.

HOUSING, Portland, Ore.

Wesco Building Co., Portland, Ore., awarded contract for total of 243 units, dwelling project, to Myers Brothers, Los Angeles, Calif., $1,401,250. Donald J. Stewart, Vancouver, Wash., is the architect and Beasley & Stoehr, Portland, Ore., are the engineers.

SERVICE SCHOOL GROUP, Farragut, Idaho

Bureau of Yards & Docks, Navy Dept., Washington, D. C., awarded a letter of intent for 5,000-man service school group at Naval Training School to C. F. Davidson Co., Tacoma, Wash., at $2,105,800.

HOUSING, Richmond, Calif.

Housing Authority of City of Richmond, Atchison Village, awarded contract for 494 family dwelling units, community building, child service center and site improvements at Seaport War Apartments to Standard Building Co., San Francisco, $842,815. Albert F. Roller, San Francisco, and Keith Narbett, San Francisco, are architects; also 368 family dwelling units, community building, child service center and site improvements, Pullman War Apartments, to S. J. Amoroso Construction Co., San Francisco, $696,300. Miller & Warnecke, Oakland, are architects.

HOUSING, California

U. S. Engineers, San Francisco, Calif., awarded a contract for constructing additional housing, Siskiyou County, to Ford J. Twaits Co. and Morrison Knudsen Co., Inc., Los Angeles, at $800,000.

HOSPITAL and NURSES HOME, Portsmouth, Va.

Federal Works Agency, Washington, D. C., received the lowest bid from J. O. Burgwin & Co., Pittsburgh, Pa., for a hospital and nurses' home at $847,400. J. E. Edmunds, Baltimore, Md. and Rudolph, Cooke & Van Leeuwen, Norfolk, are the associate architects.

HOUSING, Allentown, Pa.

Rubin Construction Co., New York, N. Y., was the lowest bidder for constructing 260 units housing, when Allentown Housing Authority, Allentown, opened bids, at $732,850. Public Housing Authority, Washington, D. C., will finance. G. E. Yundt, Allentown, Pa., is the architect.

Note—Additional bidding and contract news on many projects large and small appear in the Construction News section beginning on page 74.

Producers Council sees 16 billions of building

At its semi-annual meeting, held last week in New York, The Producers Council, national association of manufacturers of building materials and equipment, received a report from its postwar committee that construction volume for the five years beginning about twelve months after the war is over will approximate $16,000,000,000 annually. Presented by Wilson Wright, economist of the Armstrong Cork Co. and chairman of the committee, the report allows for a 35 per cent increase in the general price level as compared with 1940 prices. About a $9,000,000,000 volume is charted for the first year after the war, when reconversions and readjustments will tend to hold down construction activity.

In the 16 billion dollar years, residential building will account for $6,400,000,000, on the basis of 970,000 dwelling units; public works for $5,000,000,000 (20 percent federal and 80 percent local); commercial building $2,000,000,000; industrial building $850,000,000; farm buildings $585,000,000; and public utilities $1,300,000,000. Such a program, Mr. Wright estimated, would employ 6,250,000 persons.

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Floating warehouses of concrete for Army

The Maritime Commission has awarded contracts for 25 reinforced concrete lighters to Concrete Ship Constructors of National City, Calif.

The lighters are to be constructed at the request of the Army, which plans to use them as storage barges in the South Pacific war zone. With a carrying capacity of approximately 2,000 long tons each, the lighters will be 265 feet long and 48 feet wide.

Concrete Ship Constructors is now completing delivery of 22 concrete oil barges, which the commission is having built for the Navy. Delivery schedule on the new concrete vessels is 3 in January, 6 in February, 6 in March, 6 in April and the remaining four in May.

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J. R. Law appointed chief of Wisconsin highways

Announcement has been made of the appointment, by Gov. Goodland, of James R. Law, mayor of Madison, Wis., as chairman of the Wisconsin State Highway Commission. The appointment, which carries an annual salary of $6,500, is subject to confirmation by the state senate. Mr. Law, who has been Madison's chief executive since 1932, succeeds William H. Armstrong, who died Oct. 5.

OBITUARY

John W. Ripley, 73, structural engi-er, who helped prepare in 1905-1906 master plan for New York's East er Piers, died Nov. 10. Mr. Ripley re-ved his engineering degree from Cor-ll University in 1893. After serving as ief structural engineer for John Monks Sons, he and Alan A. Robbins formed 1906 the Robbins-Ripley Co. He had en vice president and treasurer of the n. His company built the pier of the rt of Embarkation in Brooklyn, and ently designed and constructed water-nt improvements for the United States rchant Marine Academy at Kings int.

John Lane Van Ornum, 79, Professor eritus, Department of Civil Engineer-g at Washington University, St. Louis, ., died Nov. 6, at Clayton, Mo. He s appointed head of the Department of il Engineering in 1897 and served con-uously until his retirement in June, 33.

J. Matthew Carr, 55, of Columbus, io, former chief of personnel in the io State Highway Department, died v. 6.

Robert Butchart, 86, died at Victoria, C., recently. In 1888 he and his father tablished the first cement plant in nada, near Owen Sound, Ont. He ved to Victoria in 1904. Later he be-me president of the British Columbia ment Co. and the Oregon Portland ment Co. He is best known as creator the beautiful Butchart Gardens at anich Arm near Victoria.

William T. Brown, 66, first city man-er of Sumter, S. C., died Nov. 4.

C. A. Beck, 67, retired building con-ctor of High Point, N. C., died Nov. 4.

Charles Paige Lawrence, 66, former y engineer of Warren, Ohio, and umbull County maintenance engineer m 1921 to 1933, died Oct. 31. A native Elyria, Ohio, he was county surveyor Lorain County from 1910 to 1912, nt to Warren in 1913 and was city gineer from 1916 to 1921.

Lt. Leonard A. Keyes, Jr., 27, son of onard A. Keyes, vice-president of J. P. organ & Co., Inc., and a graduate of rinceton University in engineering, was lled in the crash of an Army bomber July 14. He had been reported miss-g until early this month. Lieutenant eyes was a civil engineer who enlisted March, 1941, and after training was assigned to Company A, 649th U. S. Engineers. He was transferred to the Air Forces in Feb. 1942.

Lupescu M. Bernfeld, 57, chief engineer of the Manhattan office of the New York City Department of Housing and Buildings, died Nov. 14. A civil engineer and registered architect, Mr. Bernfeld was a recognized authority in his field. He was the author of a text titled "Inspection of Steel and Iron Construction" and was a member of both the American Institute of Architects and the National Society of Professional Engineers.

John P. Maguire, 55, field superintendent for the E. B. McGurk Construction Co., Hartford, Conn., died in that city on Nov. 7. He was active in roadbuilding and had previously been connected with the L. Suzio Construction Co., the Edward Balf Co., and at one time was in business under his own name.

James A. Smith, 84, former head of the Cleveland, Ohio, Engineering & Construction Co., died Nov. 2.

Roy Sederburg, 48, a Chicago building contractor for the past 25 years and recently engineer for the Defense Plant Corp., died in Chicago, Oct. 26.

News of the Week
Continued on p. 124

CONTRACTS AND CAPITAL

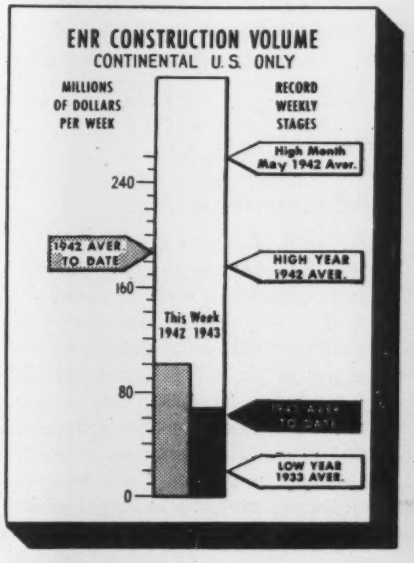
CIVIL ENGINEERING construction volume in continental U. S. totals $68,931,000 for the week. This volume, not including the construction by military engineers abroad, American contracts outside the country, and shipbuilding, is 10 percent higher than in the preceding week, but is 31 percent lower than for the corresponding 1942 week.

Private construction records the second highest weekly volume of the year. It is 140 percent above a week ago, and 569 percent above a year ago. Public work, however, is down 37 percent compared with last week, and is 69 percent below last year. Decreases in both state and municipal work and federal volume are responsible for the decline in public construction.

The current week's volume brings 1943 construction to $2,848,861,000, an average of $61,932,000 for each of the 46 weeks of the period. On the weekly average basis, 1943 volume is 67 percent below the $8,866,278,000 for the 47-week 1942 period. Private construction, $448,805,000, is 14 percent lower than a year ago, and public construction, $2,400,056,000, is down 71 percent when adjusted for the difference in the number of weeks.

In the classified construction groups, gains over last week are in commercial buildings, earthwork and drainage, and unclassified construction. Commercial buildings and unclassified top their respective 1942-week totals.

New capital for construction purposes for the week totals $5,879,000, and is made up entirely of state and municipal bond sales. New construction financing for the 46 weeks of 1943, $3,058,099,000, is 69 percent lower than the $10,201,425,000 reported for the 47-week 1942 period.



CONTRACTS

Continental U. S. Only
(Thousands of dollars)

	Week Ending Nov. 19 1942	Nov. 11 1943	Nov. 18 1943
Federal	$90,897	$43,409	$27,426
State & Municipal	3,192	2,956	1,599
Total public	$94,089	$46,365	$29,025
Total private	5,971	16,607	39,906
TOTAL	$100,060	$62,972	$68,931
Cumulative 1943 (46 weeks)			$2,848,861
1942 (47 weeks)			$8,866,278

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1942 47 weeks	1943 46 weeks
NON-FEDERAL	$622,239	$304,261
Corp. Securities	174,989	18,228
State & Mun.	208,095	120,355
R.F.C. loans	156,455	14,545
FPHA loans	.....	3,133
R.E.A. loans	.....	20,000
Fed.-Aid Hwy.	82,700	128,000
FEDERAL	$9,579,186	$2,753,838
TOTAL CAPITAL	$10,201,425	$3,058,099

ENR INDEX NUMBERS

Index Base=100	1913	1926
Construction Cost. Nov. '43	294.41	141.52
Building Cost. Nov. '43	231.39	125.08
Volume Oct. '43	142	62

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

"Dunking" Bridge

Sir: Your article, "Britain to Basra and Beyond" (*ENR*, Sept. 30, 1943, p. 408) is a brilliant job of reporting. This war has seen unprecedented use of engineer correspondents in foreign fields, for which *ENR* is to be congratulated as a most progressive leader.

In your article I was particularly interested in the account of Brigadier Hull's "sinking bridge." More properly, this type of structure should be called a "dunking" bridge, as it has been so designated heretofore. I refer you to *Civil Engineering*, Vol. 10, pp. 610, 680 and 754. While the pioneer structure at Nonesuch Narrows existed only in the imagination of Ken Bridgewater, alias Noah G. Neare, alias me, the comment pro and con three years ago agreed that this was a colorful name for an improbable contraption.

You see, "sinking" implies uncontrolled and involuntary descent through a fluid medium, but "dunking" means the controlled and purposeful descent and subsequent ascent through the medium. Stemming from the German *dunken*, to dip, which gave us Dunker and Dunkard, *dunk* is not bastard slang. For lack of an equivalent root in Latin or Greek, it will have to do.

R. ROBINSON ROWE
Sacramento, Calif.

Analysis of Continuous Beams

Sir: The article by Joseph Zalkin entitled "How to Analyze Continuous Beams for Combined Dead and Live Loading" in *Engineering News-Record*, April 8, 1943, p. 486 proved interesting reading, but showed nothing that could not be found in a good text book on indeterminate stresses.

While the Hardy Cross method of "Moment Distribution" is a very ingenious method for solving indeterminate stresses, I believe for this type of problem, the "Precise Method of Moment Distribution" described by Joseph A. Wise in *Journal of the American Concrete Institute*, Vol. 33, p. 93 (Nov. 1938) is much simpler and takes less time to get the desired results. Mr. Wise in his article gives a complete derivation of the equations used.

Using the example of Mr. Zalkin, I determined the moments at the supports for dead load only by the following methods: (1) Theorem of three moments; (2) Slope deflection, and (3) Precise moment distribution.

The following table shows a comparison of the results with those of Zalkin.

	Three-Moment Theorem	Slope Deflec.	Precise	Zalkin
M_a	0	0	0	0
M_b	24.1	24.2	24.3	24.6
M_c	33.8	33.3	33.4	34.4
M_d	30.0	30.3	29.3	25.6
M_e	43.1	43.6	43.2	45.2
M_f	0	0	0	0

Inspection of the table will show that the results of the precise method agrees more closely to the results obtained by the theorem of three moments and slope deflection methods. It is necessary to continue the Hardy Cross method for many cycles to determine the final moments where as the precise method gives the results in one operation.

SIDNEY L. GOLDBERG,
Civil Engineer,
Galveston, Texas

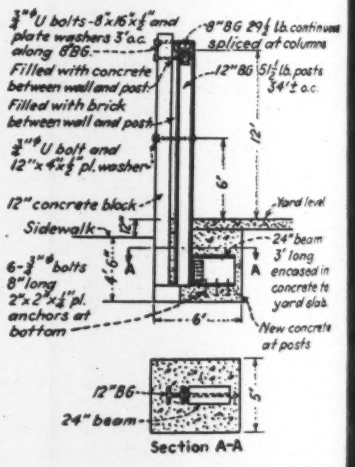
Wind Pressure on Walls

Sir: In *ENR*, Oct. 21, p. 630, H. H. Sweet recommends general conclusions in connection with the construction of masonry walls which seem so conservative that dissention from his conclusions should be recorded. If the recommendations in his article find their way in specifications and building codes, masonry walls of 12 in. or less in thickness will become theoretically unsafe and illegal, since very few walls are less than 10 ft. in height. Yet we know from experience, and the recent severe weather conditions along the eastern seaboard confirm such experience, that free standing walls 10 ft. or more in height made of 12-in. and in some cases 8-in. hollow masonry units, do withstand winds running into gale velocities.

The author's Fig. 2 seems to indicate that the gust velocity is always 20 miles per hour greater than the true (average 5 min.) velocity, for all true velocities above 45 miles per hour. The basis of this figure is not given. The more important question of wind velocity variations with height above surrounding ground seems to be disregarded.

The author's method of computing necessary wind resistances, requires walls which are more stable than those designed to sustain normal earth pressure. It is true that a strict interpretation of building codes make wind pressure a stricter requirement than earth pressure in as far as wall design is concerned. However, seldom are the building code requirements on wind pressure applied to masonry walls of low buildings.

Some fifteen years ago, the writer was asked to design a reinforcement for an existing masonry block fence wall approximately 12 ft. high which


3/4"ø U bolts-8"x16"x1/4" and plate washers 3' o.c. along 8"B6
8"B6 29# Lb. continuous spliced at columns
Filled with concrete between wall and post
12"B6 51# Lb. posts 3'-4" o.c.
Filled with brick between wall and post
3/4"ø U bolt and 12"x 4"x1/4" pl. washer
12'
6'
12" concrete block
Yard level
Sidewalk
24" beam 3' long encased in concrete to yard slab
6-3/4"ø bolts 8" long 2"x 2"x1/4" pl. anchors at bottom
6'
New concrete at posts
12"B6
24" beam
5'
Section A-A

stood without apparent damage for some years, but due to a legal difficulty it was forced to comply with all the requirements of the New York City building code. Even though the Brooklyn Department admitted the ridiculous situation requiring this fence to sustain a wind pressure of 30 lb. per sq. ft. (N.Y.C. building code requirement, reduced in the 1938 revision, when the entire code was

changed), legal requirements governed and the extremely heavy reinforcing shown on the sketch enclosed was designed and actually built.

If the author's recommendations become standard, similar type of reinforcement for masonry walls should be installed for all fences, one story separating walls and similar conditions. An investigation of the strength of walls in one story factory buildings will indicate serious instability conditions, unless, as is reasonable, a reduction in expected wind pressures is assumed near ground surface.

JACOB FELD,
Consulting Engineer,
New York

Wind Pressure on Walls

Sir: The article in *Engineering News-Record*, Oct. 21, 1943, p. 630, by H. A. Sweet, and your editorial, p. 586, of the same issue on the subject of "Resistance of Brick Walls to Wind" may open up some interesting discussion on this often neglected subject. Since the building mentioned was under construction, it would be interesting to know the length of time the wall had been standing before failure took place.

The value of 31 psi. used is open to question, as from Report BM55 all failures occurred at the loading roller, which may have been local failures or shear failures instead of tension failures.

However, I believe a more nearly correct way to determine the strength of this wall would be to construct a force diagram, neglecting the tension in the mortar, which is likely to vary from zero to 50 psi. Also, brick and mortar are brittle materials and can take little deformation, which would indicate that Hooke's law may not apply. Assuming the resultant to hit the edge of the base, we would have the following formula for the horizontal force necessary to overturn the wall:

$$H = \frac{\text{(Total wt. of wall)} \times \text{(depth of wall in inches)}}{\text{(height of wall in inches)}} \quad (2)$$

This equation gives a total horizontal load of 207 lb. or 4.14 lb. per sq.ft. instead of 2.5 lb. per sq.ft., or about 28 m.p.h. as the wind allowed instead of 22 m.p.h. as calculated by Mr. Sweet.

It hardly seems likely that a properly constructed wall good for 28 m.p.h. would fail at 32 m.p.h. and there may have been some other contributory causes of failure.

P. F. CAMPBELL
Structural Engineer
Rust Engineering Co.
Pittsburgh, Pa.

More on Sutro Weirs

Sir: To supplement the letter to the editor from Charles H. Capen, on the history of Sutro weirs, (*ENR* October 21, 1943, p. 75), I would call to your attention that the late John H. Gregory installed proportional weirs on the outlet end of grit chambers at the Albany, N. Y. sewage treatment works in 1915–1916 (*Engineering News*, June 22, 1916, pp. 1164–1166). However, the plans were prepared early in 1912 (*Engineering News*, October 7, 1915, pp. 692–695). Gregory states (*Engineering News*, June 22, 1916):

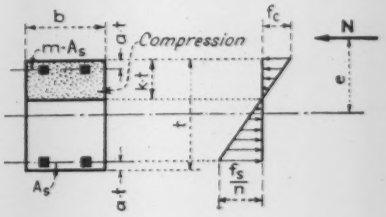
"Proportional weirs are not new and have been used for several purposes, and rectangular weirs have been used at the outlet end of grit chambers. As far as the writer is aware, however, the Albany grit chamber is the first one under construction in which a proportional weir is to be used for controlling the flow through the chamber . . . although the writer designed a grit chamber for Trenton, N. J. some two years ago, nearly as large as, and quite similar to, the Albany one, and in which a proportional weir was included."

The writer saw the Albany weir in 1919, shortly after the plant was put in operation. It was described as a Sutro weir in the report of the Commissioner of Public Works, Albany, N. Y. for the year ending December 1, 1920, p. 58.

LANGDON PEARSE
Sanitary Engineer
The Sanitary District of Chicago
Chicago, Ill.

Doubly-Reinforced Beam Design

Sir: The writer was interested in the article, "Simplified Equations for Concrete Beams," by J. F. P. Tate, (Sept. 9, p. 388), which presented equations for solving for the stresses in a reinforced concrete beam of given properties and under specified load conditions. Previously, methods of review and design have been presented by the Portland Cement Association, the Public Roads Administration, and other agencies and individuals. The writer believes the use of the charts appearing in "Eccentric Loads on Concrete," by L. T. Evans (Edward Brothers, 1943), furnishes a more simplified and direct method of analysis.



The sketch shows a concrete section subjected to a direct load N, acting at a distant e from the mid-depth. By definition, $\phi = \frac{e}{t}$ and $p = \frac{As}{bt}$. In the problem discussed by Mr. Tate, $N = O$, e is infinitely large, and hence $\phi = \infty$

$$p = \frac{As}{bt} = \frac{2.0}{14 \times 23} = 0.00621$$

Also, $a = \frac{2}{23} = 0.087$, and $m = \frac{2.53}{2.0} = 1.265$

From charts in the aforementioned "Eccentric Loads on Concrete," the following values are obtained:

for $m = 1.0$ and $a = 0.1$, $k = 0.252$ and $L = 0.132$
for $m = 2.0$ and $a = 0.1$, $k = 0.228$ and $L = 0.150$
for $m = 1.0$ and $a = 0.2$, $k = 0.251$ and $L = 0.097$
for $m = 2.0$ and $a = 0.2$, $k = 0.244$ and $L = 0.101$

Interpolating between $m = 1.0$ and $m = 2.0$ to obtain values for $m = 1.265$, and extrapolating between $a = 0.1$ and $a = 0.2$ to obtain values for $a = 0.087$, we have:

for $m = 1.265$ and $a = 0.087$, $k = 0.246$ and $L = 0.142$

Using these values in the basic equations of this method (which are derived in the book), we have:

$$f_s = \frac{M}{Lbt^2} = \frac{900{,}000}{0.142 \times 14 \times 23^2} = 855 \text{ p.s.i.}$$

$$f_c = nf_s\left(\frac{1-a}{k} - 1\right) = 10 \times 855 \left(\frac{1 - 0.087}{0.246} - 1\right) = 23{,}200 \text{ p.s.i.}$$

The method applied herein is fundamentally correct, it is simple and easy to apply, and produces results within the usually accepted limits of accuracy for reinforced-concrete design.

CARL R. WILDER,
Inglewood, Calif.

EDITORIALS

VOLUME 131 NUMBER 21

November 18, 1943

Disquieting Suggestion

FOR THOSE WHO HAVE BEEN HOPING that local postwar public works could be carried on without federal subsidy, the report which Robert Moses, New York City park commissioner, rendered on the Portland, Ore., metropolitan region last week contains a disquieting suggestion. It is that Portland can probably count on federal financial assistance up to probably 50 percent of the cost of the $75,000,000 program. The basis for such an assumption is unclear. The federal government has made no pronouncement of its intention to revive grants-in-aid, and indeed it has been widely assumed that city finances are in such good shape that no such aid will be necessary. If Mr. Moses, one of the nation's ablest city planners, thinks local public works must be financed by the federal government as a general and continuing policy, it is time for the subject to be dusted off and discussed.

Small Bridges in a Big Program

MANY LARGE-SCALE POSTWAR PROGRAMS for street and road construction are being planned that include large bridges and expensive viaducts. Such projects receive considerable attention because of their immensity, but of equal if not greater importance is the part to be played by the construction of thousands of small bridges and drainage structures necessary for the rebuilding and maintenance of our present highways. Detailed planning now and energetic prosecution of such a nation-wide bridge building program is of primary importance and should receive the serious attention of the county engineer as it applies to the needs of his county; the municipal engineer who necessarily must improve his city's streets; and the state highway engineer who realizes that such a program is required to keep postwar traffic rolling. Even before Pearl Harbor many of our small bridges were in a deplorable state of disrepair and, with the ensuing decrease in wartime bridge maintenance, they can only be brought up to prewar standards by a concentrated program of reconstruction. Inasmuch as each small structure usually can be treated as an independent project, no great engineering force is required to make surveys, prepare plans and estimates. Treated individually, postwar plans for small bridges can be made a simple procedure, yet viewed collectively the results of such a nationwide program would be most beneficial to any postwar employment problem, and would, as well, improve the highway transportation facilities of the country.

Slide Rules for War

SLIDE RULES are critically scarce, actually unobtainable except with high priority ratings, yet there are undoubtedly many good slide rules not now in use. Some of them may be the almost forgotten property of engineers who have gone into other work where a slide rule is seldom or never used; or they may be the property of individuals who need them only occasionally, when they could easily be borrowed from an associate; and some may belong to men in non-technical work in the armed forces. How can such slide rules be put in the hands of those who need them? Sale to local bookstores or engineering supply houses is perhaps simplest, but has not met the present need. One solution might be circular letters from engineering societies and engineering colleges to their members and alumni. Such organizations could suggest that available rules be sent to them, as a gift where practicable, for resale at a nominal price, with the proceeds devoted to the organization or to a charitable cause. The War Production Board has endorsed this latter suggestion, and advised that there is no restriction on second-hand transfer of this type. Instrument manufacturers welcome any relief from the pressure they are under to supply more than they can produce. There is an opportunity here for a contribution to the war and to a worthy cause.

Foundations for Postwar Structures

FOUNDATION INVESTIGATIONS are a necessary part of all economical engineering planning because nearly all foundation difficulties can be traced to inadequate programs of subsurface exploration, to insufficient care in taking and preserving samples and, probably to a less degree, to improper interpretation of the samples. One of the most important aspects of postwar planning is to have the projects ready so that they can start quickly and continue without delay. Therefore, as soon as approximate loads are known, and available sites are narrowed to one or two, subsurface investigation should be undertaken to determine the time and money required to secure a suitable foundation. A recent article describing difficulty with a building in Brazil

and an article in this issue relating how samples not properly preserved contributed to delay are a reminder of the engineer's duty to get subsurface data adequately, interpret it wisely and use it judiciously. Such data may indicate extensive changes in design, but making them in the planning period is much to be preferred to changes in the field or on a completed structure.

Fast Construction

MACARTHUR LOCK at the Soo stands as another of the remarkable records for fast construction that have been written during the war. It was built in 14 months as compared to more than twice that time for Davis and Sabine locks, which were similar in size. However, we would be losing proper prospective if we fail to recognize that more than a quarter century of development in construction equipment took place between the building of Sabine and MacArthur locks, also that cost rather than speed was a controlling factor when the earlier locks were built. This latter fact needs to be recognized when we get back to more normal living after the war. When careful balancing of cost again becomes a factor to be taken into account, we cannot expect such high rates of construction.

A Challenge to Hydraulic Designers

A HOLE 112 FT. LONG and 36 ft. deep was eroded in the foot of the inclined spillway tunnel on the Arizona side at Boulder Dam during the five months that the spillway was in operation during the fall of 1941. The average flow down the steep incline was 13,000 cfs., about one fifteenth of the maximum designed capacity of the tunnel. What caused the erosion is unknown, but available evidence points to cavitation resulting from slight irregularities in surface and alignment where the incline tunnel intersects the horizontal tunnel.

That this happening is of major significance in the field of hydraulic design is evident from an examination of the photographs and drawings reproduced elsewhere in this issue. Elaborate model studies preceded approval of the spillway design, for it was recognized that with the unprecedented quantities of water to be handled and the unprecedented drop in the spillway, destructive forces could be developed. These studies showed that even minor irregularities in the surface of the model tube would cause great turbulence in the lower part of the spillway tunnel. Further studies with jets impinging on concrete surfaces did not indicate, however, that such turbulence as would occur would release forces that could be expected to damage the concrete lining of the tunnel.

That the forces developed were beyond the magnitude of those indicated by the model studies is clear from evidence found in the great hole cut through the lining and deep into the underlying rock. Cavitation, that baffling force that has plagued builders of hydraulic turbines and propellers for many years, appears to have been active on an unprecedented scale. According to some authorities, cavitation may produce compressive stresses as high as 1,000 atmospheres when the vapor pockets caused by turbulence collapse. When close to the concrete lining, these rapidly repeated shocks might well cause fatigue failure. The surface of the tunnel lining below the hole shows that it was subjected to severe punishment.

Vibration also appears to have been a possible factor in enlarging the hole once the attack got under way.

Worthy of note in connection with the erosion in the Boulder spillway tunnel is erosion of a lesser extent that has taken place more recently on the bucket of the spillway at Grand Coulee Dam where the overfall is of unprecedented height. Both these happenings serve to emphasize that a model gives true indication of what a prototype will do only so far as the theory of homologous similtude holds true. This theory, according to hydraulic turbine designers who have relied upon models for a long time, does not apply for cavitation and vibration. These forces cannot be reproduced in a model; all that can be learned is where to expect them to be of such significance as to call for special precautionary measures.

Since we must learn of the effect of these forces chiefly by experience, particular importance attaches to full scale tests such as those at the Boulder and Grand Coulee spillways. The damage done at Boulder does not indicate that too great a risk was taken, nor is it a reflection on the designers who had the courage to specify concrete for the tunnel lining instead of insisting on a much more costly lining of steel. The greater risk is that we may fail to benefit fully from that happening and the more recent one at Grand Coulee. These developments stand as a challenge to hydraulic engineers.

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Photos by U. S. Army Engineers

Fig. 1. MacArthur Lock at Sault Ste. Marie, Mich., built in the unusually short time of fourteen months.

MacArthur Lock at the Soo

J. Roland Carr
Assistant Editor, Engineering News-Record

***Contents in Brief**—Operational features of latest design are incorporated in the recently completed MacArthur Lock in the St. Marys River at Sault Ste. Marie, Mich. Completion of this $14,000,000 ship lock in 14 months sets a new record for lock construction. Located on the site of the old Weitzel Lock built in 1881, it completes a battery of four American-owned locks, and its construction marks an important milestone in the progress of Great Lakes transportation. More than 200,000 cu. yd. of concrete were poured in the approach canal walls and in the lock itself; with much of it being placed and successfully cured in temperatures ranging to 30 deg. below zero. The lock is 800 ft. long, 80 ft. wide, and it overcomes a drop of about 22 ft. between Lake Superior and Lake Huron.*

EACH SECOND SAVED is worth five tons of freight. That is the operational slogan of the recently completed MacArthur Lock in the St. Marys River, at Sault Ste. Marie, Mich. Night and day throughout the shipping season on the Upper Great Lakes the peaceful quiet of the twin cities of Sault Ste. Marie on the American and Canadian banks of the river is broken by the plaintive whistles of ore steamers demanding passage through either this new lock or one of the four others previously built.

To a newcomer, the monotonous regularity of the ship signaling may be distracting, but to those who saw this $14,000,000 project completed in the record-breaking time of 14 months, it is a continual salute to the resourcefulness and determined perseverance of those officers in the Corps of Engineers of the U. S. Army, civilian employees and constructors who built the lock with such exceptional speed.

Officially designated the "MacArthur Lock," according to an act of Congress honoring General Douglas MacArthur, commander of our armed forces in the Southwest Pacific and a former Engineer officer, it occupies the site of the old Weitzel Lock which, due to its shallow depth, has not been used for locking freighters since 1918.

Construction of a modern lock on this site had long been contemplated and, following Pearl Harbor, the issue was brought to a head and design plans were completed by the U. S. Army Engineers. Preliminary construction got under way April 20, 1942, with official notice to proceed being issued May 14. Construction was officially completed and the lock opened to normal operations on July 11, 1943. Termed the "jugular vein in the United Nations' war effort," this latest innovation in deep-draft ship locks is playing an important role in increasing war production by permitting the passage of a greater number of heavily laden vessels carrying war-essential iron ore and grain from Lake Superior into the St.

Marys River thence to Lake Huron and the receiving ports of the Great Lakes.

In addition to the MacArthur Lock, there are three American-owned locks at Sault Ste. Marie, or more commonly called the "Soo." Two of these locks, the Poe and Davis, were named after U. S. Army generals, while the third recently was designated the Sabin Lock in honor of L. C. Sabin, for many years general superintendent of the canal at the Soo. These four locks and the St. Marys Falls Canal in which they are located, are a part of the federal government's program of deep-draft navigation on the Great Lakes. Construction, maintenance and operation of the locks and the canal are under the jurisdiction of the Corps of Engineers, U. S. Army.

The 63-mi. long St. Marys River flows in a southeasterly direction, connecting Lakes Superior and Huron. Turbulent rapids in the river at Sault Ste Marie, located 14 mi. below the head of the river, are ½ mi. wide, ¾ mi. long, with a total drop of about 22 ft., depending on the levels of lakes Superior and Huron. Irregular outcroppings of Potsdam sandstone ledges, causing these impassable rapids, are visible during periods of low water. The four American locks parallel the rapids on the south side, while one Canadian-built canal with a lock of somewhat smaller dimensions is located on the north side of the river and operated by Canadian authority.

Built as a permanent installation

The MacArthur Lock is 800 ft. long, 80 ft. wide, and 59 ft. deep with a 31-ft. depth of water provided over the miter sills. Its average lift is 21.7 ft., based on the current low water datums established for Lakes Superior and Huron and corrected for the gradient of the St. Marys River. Although being assigned a high priority rating because of its strategic importance to the war effort, it nevertheless encountered considerable difficulties in securing a continual supply of critical materials needed for its uninterrupted construction. In view of the anticipated useful life of the lock, it was designed as a permanent structure, and not as a strictly wartime project, although noncritical materials were substituted wherever feasible. For instance, certain sealing joints, originally designed to employ rubber or other critical materials, were constructed with timber facings.

The importance of this installation to the war effort can not be overestimated. An exceptionally late opening of lake navigation this season, due to a late break-up of the ice-bound waterways, immediately placed the movement of freight through the locks some 10,000,000 tons behind last year's schedule. With the full operation of the new lock being effected in July, it is hoped to have the tonnage being moved back on schedule by the end of the shipping season. Although the total tonnage of freight passing through this most

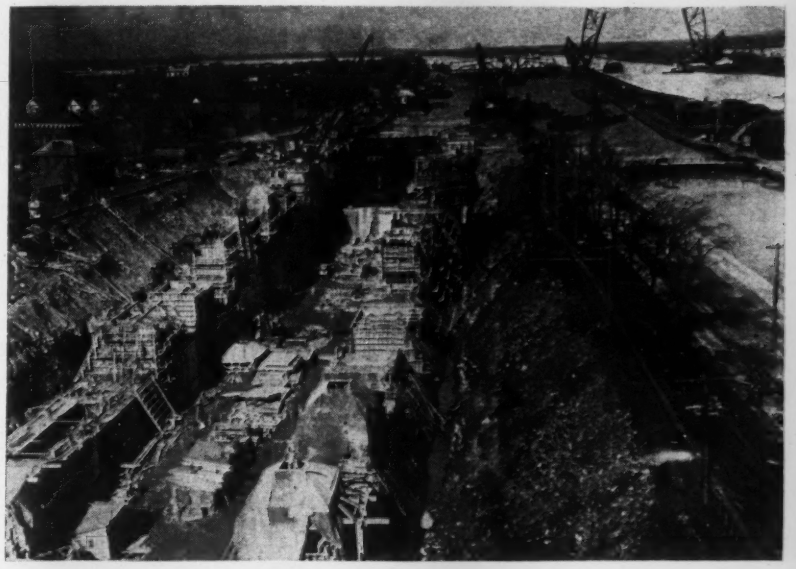


Fig. 2. Huge concrete monoliths forming the lock walls were poured in alternate sections 30 ft. long. Beyond the two lock gates shown at the upper miter sill is an emergency bulkhead impounding water from Lake Superior to keep the construction area in the dry. The old Poe Lock lies adjacent to the new lock, and the approach canal spanned by the bascule bridge at the upper right, leads to the Davis and Sabin locks.

Fig. 3. Clay-filled, cellular cofferdams, resting directly on the sandstone riverbed were constructed first, to dewater the construction area. Following the installation of the watertight steel bulkhead, shown in the foreground, the cofferdam was removed and the approach canal dredged to its required depth.

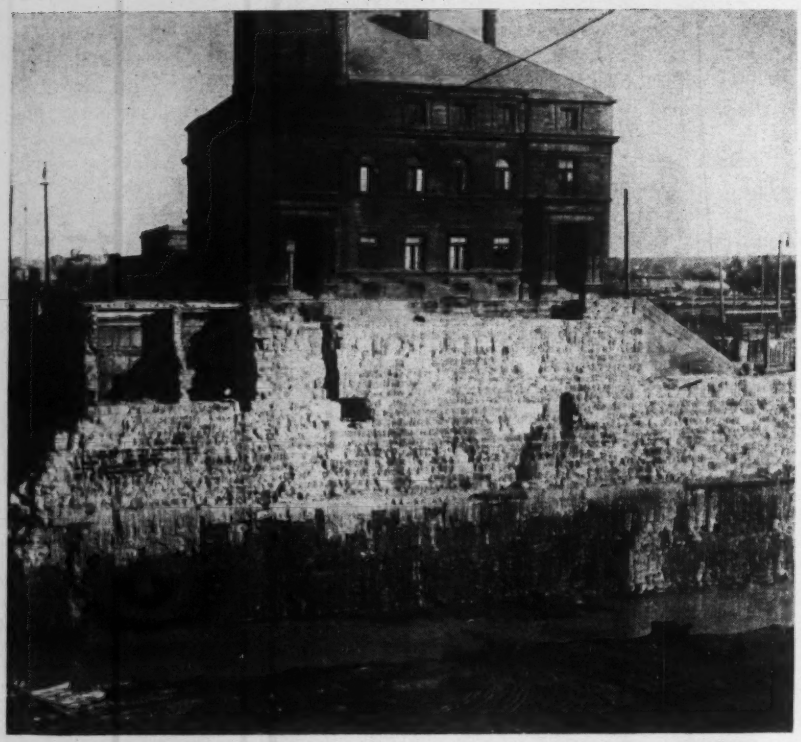


Fig. 4. Old masonry foundation of the administration building was chipped away by jackhammers to provide room for the north lock wall. Openings at left are coal-storage bins for the heating plant.

important of the world's fresh water canals can not be divulged at present, it can be stated that both monthly and daily all-time high records have been far surpassed. Although the principal function of the MacArthur Lock is to insure continuous movement of lake traffic, it is also of inestimable value in expediting the passage of great numbers of vessels that occasionally become fog-bound and congest above and below the locks.

Historical background

Long before the coming of the white man, the Indians were obliged to portage their canoes around the rapids to get from one lake to the other. With the development of fur trading in connection with the settlement of the Northwest, larger boats were used, resulting in the costly and laborious work of unloading them, hauling their cargoes around the rapids in wagons and reloading into other boats. This expensive portaging led the Northwest Fur Co. in 1797, to build a small lock 38 ft. long, 8 ft. 9 in. wide, with a 9-ft. lift, on the Canadian side of the river. Supplementing this lock was a ½-mi. long canal extending to the upper end of the rapids. The lock was destroyed by U. S. Army troops in 1814.

Considerable military activity centered around the portage during the Colonial and Indian wars and the War of 1812. Its strategic location and value as an important link in the Great Lakes transportation system vitally affected the economic development of that section of the country.

Following the demolition of the Northwest Fur Company's lock, no further attempts at canal building were made in this remote spot until 1853, when the State of Michigan constructed the first ship canal at this site. It was called the State Canal and it contained two 350-ft. long tandem locks, 70 ft. wide and carrying boats of 12-ft. draft. The Weitzel Lock was completed by the U. S. Engineers in 1881, and the Poe Lock replaced the State Lock in 1896. The two identical locks, Davis and Sabin were finished in 1914 and 1919, respectively. The Canadian-owned lock on the north side of the river was completed in 1895.

Three separate contracts

Contract work for the MacArthur Lock project was let in three separate units, but to a single contractor. These units were: (1) removal of the existing Weitzel Lock and excavation for the new lock, including construction of a cofferdam above and below the site, (2) construction of the new lock and (3) removal of cofferdams, and dredging the south approach canal down to a specified depth. One company secured all three contracts.

From the very beginning to the final completion, construction operations were bedeviled by water, ice and snow, the steady stream of lake traffic and unforeseen difficulties. However, these hazards were overcome and construction was kept on schedule chiefly through the contractor's ability to provide an ample supply of equipment and trained personnel for the job. Much credit is also due the several subcontractors that aided with the work.

Construction records of long-standing fell as the work of cofferdam construction, demolition of the old masonry lock, excavation, concreting and machinery installation progressed at a war-geared tempo. Working on a 24-hr. around-the-clock schedule, 7 days a week, more than 500,000 cu. yd. of earth and rock excavation were removed, and over 200,000 cu. yd. of concrete were placed and successfully cured in temperatures ranging to 30 deg. below zero to form the huge monoliths in the sidewalls.

Unwatering the site

Speed was the keynote of the construction program with the job being attacked simultaneously in as many places as feasible. While the first work was started with the removal, by dredge and derrick, of the masonry walls of the old Weitzel Lock, construction also got underway on the cofferdams enclosing the construction area. The area of waterway sealed-off by the cofferdams measured 2,600 ft. long and 250 ft. wide. Steel cellular cofferdams were built out from the river bank both above and below the site. Sealing walls of deep-arch steel sheeting were built to connect the cofferdams with the Poe Lock piers. These piers and the south wall of the Poe Lock formed the north side of the enclosure.

In addition to 1,150 lin. ft. of steel cellular cofferdams and 650 lin. ft. of sealing walls required in the construction, contract items in the first contract contained several units of considerable magnitude. These included: (1) removal of 32,000 cu.

yd. of limestone masonry in the Weitzel Lock, (2) removal of 2,800 lin. ft. of timber crib piers containing 3,000,000 b.ft. of crib timbers, (3) removal of an old timber lock floor containing 1,400,000 b.ft. of lumber, (4) excavation and disposal of 270,000 cu. yd. of sandstone rock tied in with 14,000 sq. yd. of channeling and (5) excavation of 200,000 cu. yd. of earth in the embankments behind the old lock walls and piers. The work contained in the first contract was about 30 percent marine work and 70 percent in the dry.

Cofferdams founded on sandstone

No penetration into the sandstone bed of the river channel could be secured for the steel sheetpiling of the cofferdam cells. This necessitated the cells being of sufficient size so as to be stable, when filled with sand and clay, against the hydrostatic pressure of the river after dewatering the enclosed area. Cells were egg-shaped with an overall width of 48½ ft, and an effective length in the wall of 51 ft. 4 in. Each cell contained 105 pieces of sheetpiling 35 ft. long. A three-pronged assembly made of half-sections of piling, bolted together with splice angles, connected the cells together. The cells were driven and filled in 28 ft. of water. Dump-scow clay was filled in up to an 11-ft. depth over the site of the cofferdam to act as an anchorage for the piling, the cells were driven, and the balance of the fill was placed by crane and truck. The cells were further stabilized by trucking blasted rock onto the top of the filled cells and bulldozing it over on both sides. Deep arch sheeting was placed in the sealing walls connecting the cellular cofferdams with the Poe Lock piers and along the face of the piers. Three feet of tremie concrete was placed on the land side of the sheeting and about 6 ft. of riprap was placed on the river side. So well was the cofferdam constructed that, despite its being founded on a sandstone base, three 12-in. electric centrifugal pumps were ample to keep the enclosed area dewatered.

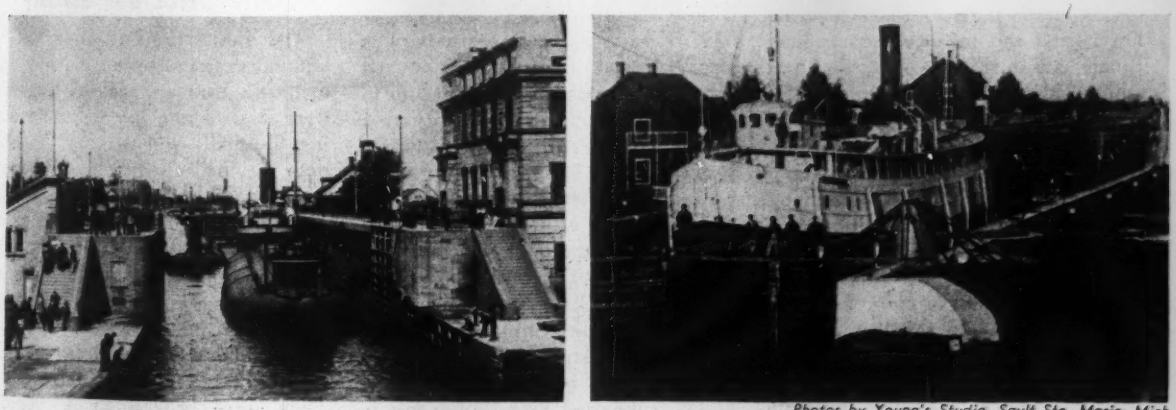
Six sets of gates

Two sets of double-leaf steel gates at each end of the lock chamber control the water level within the lock to correspond with the water levels in the approach canals. Inner gates are 800 ft. apart, c. to c. of pintles, which is called the nominal length of the lock. The two pairs of gates at each end of the lock, spaced 70-ft. c. to c. of pintles, give double assurance for continued lock-operation in the event that any one gate should become inoperative. Although not built at present, but provided for in the design, steel guard gates similar in design to the main gates will be located 70 ft. upstream and 134.5 ft. downstream from the outer main gates. They will open out into the approach canals to permit dewatering of the main chamber and maintenance work on the main gates during the winter season when the lock is not in operation, usually from the middle of December to the middle of April.

Provisions were made for the installation of emergency bulkheads 109.5 ft. upstream and 52.5 ft. downstream from the guard gates. Six 32-ton steel stoplogs, operating in vertical slots in the lock walls, form each bulkhead. By inserting these two watertight bulkheads, the entire 1,306.5-ft. length of lock can be dewatered. The primary purpose of the bulkheads was to close off the working area of the lock at an early date during construction, thus permitting the removal of the enclosing cofferdams and dredging of approach channels simultaneously with the completion of the lock proper and installation of the operating machinery. By following this procedure final completion was secured considerably in advance of what it would have been had the cofferdam been removed after completion of the lock. These bulkheads are kept at the lock for emergency use at any time.

Details of the lock

The massive concrete monoliths forming the sidewalls are unreinforced except for some temperature reinforcement in exposed concrete faces and at other locations subject to stresses from gate machinery or other operating mechanisms. Wall sections in the lock-chamber have a 12-ft. top width, a vertical front face, and a stepped back face on a slope of 3 ft. horizontal to 5 ft. vertical. The lock is filled or emptied by an 11-ft. wide by 14-ft. high filling culvert formed in each sidewall. In order to fill the lock, water flows by gravity from Lake Superior in through four 8x14-ft. steel-screened intake ports located in each sidewall just above the upper guard gate, along through the two filling culverts where 24 connecting laterals beneath the concrete floor of the lock distribute it to 264 outlet louvers in the floor. Laterals are spaced about 30



Photos by Young's Studio, Sault Ste. Marie, Mich.

Fig. 5. Completed in 1881, the old Weitzel Lock (left) was demolished to make way for the MacArthur Lock. This old picture shows two of the whaleback grain boats that were common in that period. A still older picture (right) shows the old State Lock, completed in 1855. It was torn down in 1887 and replaced by the present Poe Lock.

Fig. 6. Concreting continued throughout the winter inside of steamheated shelters of plywood and canvas. Large beveled keyways were formed in the sections of the walls to lock them together.

ft. apart throughout the lock, connecting alternately to the filling culverts. Each lateral ejects water up into the lock through eleven louvers 4 ft. long by 9½ in. wide. The eight intake ports, and the louvers were designed to permit free passage of water, based on experiments conducted at the University of Iowa, Institute of Hydraulic Research. So well do they function that turbulence of the water is hardly perceptible during filling or emptying of the lock.

When emptying the lock, water flows by gravity down through the louvers in the floor, along the laterals and into the filling culverts, thence to the discharge ports located below the lower gates and out into the approach canal. Although the discharge ports empty sidewise into the canal, their parabolic-shaped sections permit such a free passage of water that the resulting turbulence is hardly more than that caused by a canoe moving through the water. This absence of turbulence is quite noticeable in comparison with that of the adjacent old locks during filling or emptying. The flow of water into the lock is controlled by two large tainter gates located in the filling culvert just inside the upper gates. Likewise, the emptying of the lock is controlled by a gate in each culvert near the lower end of the lock.

Control houses located on each side of the lock at each pair of gates control the gate-operating machinery. The guard gates can be manually operated and provisions also are made for hand-operation of the lock gates in the event of a power failure.

Gate-operating machinery is recessed below the top of the sidewalls and covered by removable steel plates. Interconnecting between the upper and lower control houses are 4x7-ft. service galleries formed in the concrete monoliths. These galleries contain water lines, electric cables and other facilities, and they also serve as passageways between houses on either side of the lock. A 5½x7-ft. service cross-over gallery is located beneath the miter sills at each set of gates, with steps leading up to the control houses. In addition, a continuous emergency service tunnel is provided for below the lower gates, connecting by stairs with all three of the other locks at the site.

Cast iron snubbing buttons are spaced about 40 ft. apart along each side of the lock to moor the vessels while in lockage. Subjected to occasional severe stresses, these buttons are embedded in 4x4x4-ft. concrete blocks, supported by a timber pile in bearing on the rear face of the wall and braced by two reinforced concrete struts.

Timber in the old crib piers was removed by a dredge and derrick, which also removed the overburden of earth outside of the old lock. The timber was loaded on flat scows and transported either ⅔ mi. upstream or 4 mi. downstream where it was stored in timber yards. Earth removed by dredge was hauled by dump scow 13 mi. to Waiska Bay or a distance of 16 mi. to Lake Nicollet. In going over the old channel areas 12,500 cu. yd. of unblasted rock were removed. Masonry in the walls of the Weitzel Lock was wasted in Lake Nicollet. The narrow working conditions in the old lock permitted only the use of small scows.

The lower gates of the old lock were removed by the latter part of May and, early in June, the upper cofferdam was completed. The site then was drained down to the level of the downstream approach canal and the upper gates of the old lock were removed to permit further demolition and removal of the old masonry. By the middle of July the lower cofferdam was completed, the entire area was dewatered and, shortly thereafter, hard rock excavation was started for the new lock walls.

In order to permit early installation of the stop-log bulkheads at the ends of the lock, with the subsequent removal of the cofferdam, both excavation and concreting were carried on in the end sections of the lock first, with the central portion of the walls being completed last. This procedure also permitted construction of the miter sills and the installation of the gates and operating machinery to be completed on schedule.

Rock drilled with difficulty

The infiltration of water in the laminated sandstone impeded the drilling. Mud and gravel frequently were washed into the drill holes fouling the drills and making the blowouts for loading difficult. Whenever possible, dikes and drainage trenches were made in order to drain off the water to keep the area dry.

In general, drill holes were spaced 5 ft. apart each way, with an average penetration of 10 ft. This wide spacing produced some pieces of ledge rock too large to go through a dipper. They were broken by blockholing or by pounding with a ball on a crane.

Heavy blasting mats were used, and even then some rock and clay

was showered down on the nearby streets of Sault Ste. Marie. Channeling of the approach canals was accomplished by close drilling and broaching; adjacent rock was then drilled for blasting. The old masonry walls were demolished and blasting of the hard sandstone continued without a letup until early winter.

At the lower end of the lock the foundation for the administration building encroached on the area to be occupied by the new lock wall. Accordingly, the face of this old masonry was cut back on nearly a vertical plane by jackhammers to make room for the new wall which was then poured directly against the old masonry wall. All excavated rock was trucked to a nearby tipple, loaded onto a dump scow and wasted in Waiska Bay, 14 mi. distant.

Sub-zero concreting

Forms were made ready to receive the first concrete in the huge monoliths forming the side walls by Sept. 1, 1942, with all concreting being finished by the following June 26. Wall sections were poured in 30-ft. lengths, with alternate sections being finished during the first round to provide working space around each monolith. This was followed by casting the intervening monoliths to form the completed walls. Concreting continued throughout the winter despite the sub-zero temperature. Monoliths to be poured were completely enclosed with plywood shelters roofed over with canvas covering. Steam heat from eight boilers was applied to the freshly poured concrete for five days, with electric blowers circulating the heat throughout the protective shelters.

Each 30-ft. long monolith was poured in several lifts, with horizontal joints formed as necessary. Six-inch deep, continuous beveled keyways were formed vertically in the end faces of alternate monoliths to anchor them together. Expansion was provided at each joint between the monoliths by carrying ⅜-in. thick by 2-ft. wide self-expanding cork across the top of wall and extending an additional 12-in. down the front face. The remainder of the joint was covered with a ⅛-in. coating of special bituminous cement. Watertight seals of sheet lead weighing 4 lb. per sq. ft. were placed in all vertical construction joints.

Concrete used throughout the work

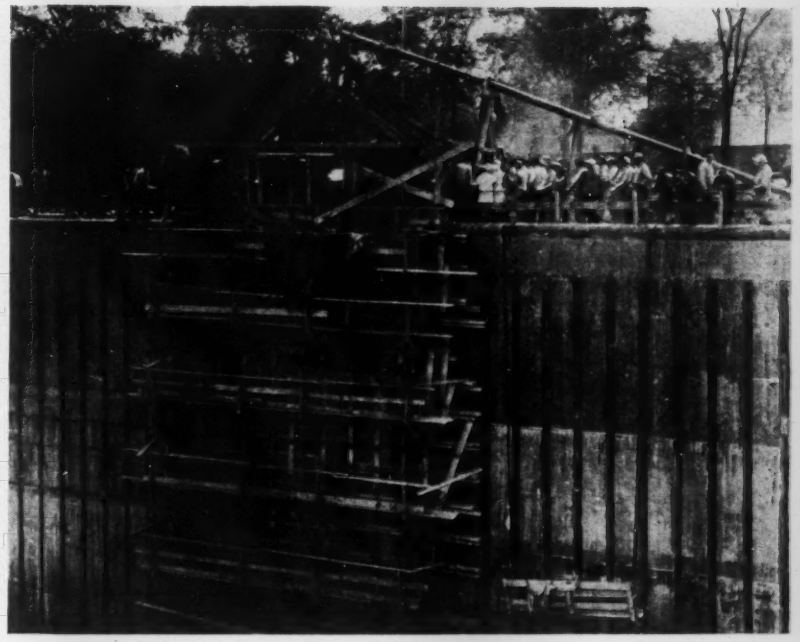


Fig. 7. Concrete was pumped into the forms through 8-in. steel pipe. Concrete forms were made of 2-in. thick planking to permit reuse.

tested on an average of 4,500 p.s.f. at 28 days, with a cement yield averaging 5 sacks per cu. yd. The concrete was mixed in a central plant, transported to the scene of operations by transit mix trucks, and pumped through 8-in. pipes directly into the forms. So efficient was the concreting procedure that 2,000 cu. yd. of concrete were placed in a 24-hr. day.

Wall armor protects concrete

Although the exposed concrete faces were case-hardened by lining the forms with an absorptive form-liner, additional precautions were taken to protect concrete from undue abrasion during normal lockage. A continuous cast iron protective curb was installed on the inside face at the top of the lock walls and anchored by 1-in. steel rods embedded in the concrete. This curb functions as a safety device in two respects. It forms a toe-hold for workmen handling the ship's mooring cables thus preventing their sliding into the lock. Also, past experience with other locks showed that the rubbing of the steel cables used to moor ships to snubbing buttons set along the banks, would eventually gouge out a recess at construction joints. Occasionally these cables would bind in such recesses, as the locks were being operated, and suddenly fly loose with sufficient force to cause bodily harm to any workmen standing nearby. The installation of the protective curbs eliminated this hazard.

It also was known that ships brushing against the sidewalls while in lockage abraded the concrete to a serious extent. To avoid this condition, wall-armor made up of 45-ft. lengths of steel tee-sections weighing 38.9 lb. per ft. was embedded vertically in the exposed face of the walls over all but the 270-ft. central portion of the lock. These tee-sections are spaced 2.6 ft. c. to c. and they have a curved outside flange face that projects ½ in. outside of the wall line to protect the concrete. Anchorage is provided by 1-in. dia. rods welded to the tees and embedded in the concrete.

Steel gates weigh 140 tons

Electrically operated steel gates at each end of the lock were prefabricated in sections and assembled in place on the job. Each leaf of the two lower gates weighs 140 tons while those of the upper gates weigh about 80 tons. All gate leaves are made of 36-in. steel beams weighing 230 lb. per ft. The beams are placed with their webs horizontal and are spaced 4 ft. 6¾ in. c. to c. at the bottom of the gate, increasing to 8½ ft. at the top. Girder flanges on the upstream side of each gate are covered with a $\frac{7}{16}$-in. steel skin plate over the entire face of the gate, while the downstream flanges carry cover plates and diagonal tie-rod bracing.

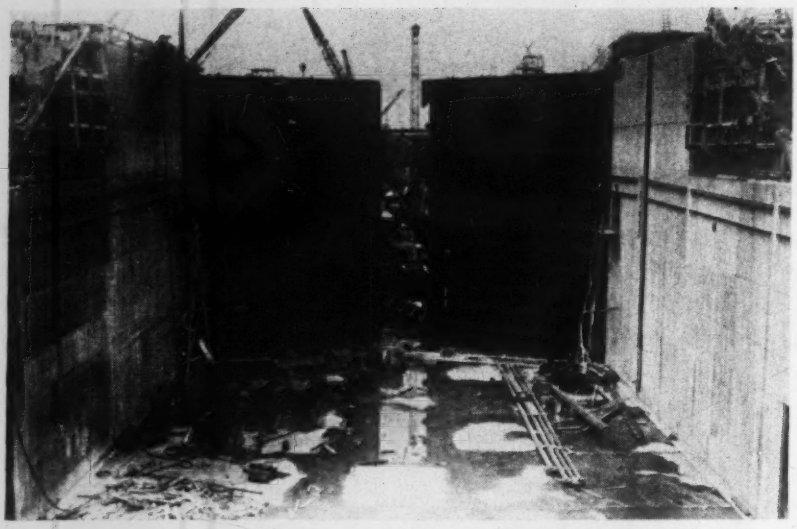


Fig. 8. Each leaf of the gates of the lower end of the lock weighs 140 tons. They were prefabricated in sections and assembled in place. Prestressed diagonals on the downstream face keep them truly vertical during operations.

Diaphragms placed vertically between the horizontal beams, and the quoin and miter girders, made out of a welded assembly of split sections of 36-in., 230-lb. steel beams and connected to the horizontal girders, complete the gate leaf.

The quoin girder pivots on a cast steel pintle at the base while the top is held in position by a 10-in. dia. gudgeon pin. A two-way anchor arm for the gudgeon pin is fastened to the concrete wall, one arm being parallel, and the other arm perpendicular, to the face of the concrete wall. These anchor arms are adjustable and, by means of a 300-lb. "Paul Bunyan wrench," the quoin girder can be adjusted into a truly vertical position. The gates measure 40 ft. 3 in. c. to c. of quoin and miter girders with an additional 2-ft. 10-in. projection at each end to the center of miter and quoin contact bearings.

Watertight closures are secured at the miter (or center of gate) and at the quoin (or hinge) by steel contact blocks placed vertically at each end of the gate leaf. The male contact block has a convex surface rounded to an 18-in. radius, while the female block has a concave surface with a 3-ft. radius. In addition, the center of bearing of the contact blocks at the quoin post are off-centered from the pivotal axis of the gate, so that full contact bearing is attained just as the gates close. Likewise, at the first movement of the gate opening, the contact seal is broken without dragging or binding.

Installation of these contact blocks for perfect closure is worthy of note. Each block, extending the full depth of the gate, was attached to vertical flanges of supporting sections of steel beams located at the miter girder or quoin post. Cap screws operating through the beam flanges adjusted the contact blocks into perfect bearing throughout their entire lengths while the gates were closed, leaving approximately a [illegible]-in. opening between the flange of vertical beam and back of the contact blocks. After all final adjustments had been made with the gate in a mitered position this opening was filled with molten lead. Contact blocks are the same width as the beam flanges, and side plates welded to the sides of the flanges enclosed the pocket to be filled with hot lead.

TABLE OF CONSTRUCTION DATA ON THE SOO LOCKS

Lock	Built	Length (ft.)	Width (ft.)	Depth of water on sills (ft.)	Cost, including canal construction and improvements
Northwest Fur Co.	1797–98	38	8¾	(9 ft. lift)	Not recorded
State (2 tandem locks)	1853–55	350	70	(9 ft. lift)	$1,000,000
Weitzel	1873–81	515	80 (in canal) 60 (at gates)	14	$1,060,000
Poe	1887–96	800	100	18.6	$3,000,000
Canadian-owned	1888–95	900	60	18.6	$5,000,000
Davis	1908–14	1,350	80	24½	$6,000,000
Sabin	1913–19	1,350	80	24½	$3,275,000
MacArthur	1942–43	800	80	31	$14,000,000

Northwest Fur Co. canal was destroyed in 1814 by U. S. Army troops. State locks were replaced by the Poe Lock. Weitzel was replaced by the MacArthur Lock.

Gates operated through a sector g[illegible]

Instead of the conventional c[illegible] arrangement attached to the bot[illegible] flange for gate operation, these g[illegible] are opened and closed by a steel s[illegible] attached to a short vertical pin n[illegible] the top of the gate and located [illegible] ft. from the quoin girder diaphra[illegible] This strut is operated off a sec[illegible] gear of 6-ft. radius, rotating thro[illegible] an angle of 158 deg. during the op[illegible] ing or closing of the gate. The sec[illegible] gear is powered by a 25-hp. elec[illegible] motor and it has a total gear red[illegible] tion ratio of 2,391 to 1. An ice ere[illegible] recess, formed in the walls of the l[illegible] insures complete opening of the ga[illegible] during periods of freezing weath[illegible]

To provide a feather-touch betwe[illegible] gate leaves and lock walls, as well [illegible] to eliminate any operational sh[illegible] being transmitted to the sector ge[illegible] and operating machinery, each st[illegible] arm connecting the gate to the ge[illegible] contains three double sets of c[illegible] mium-plated, steel helical spri[illegible] made of 2$\frac{1}{16}$-in. dia. rods. Th[illegible] springs exert a 20,000 lb. fo[illegible] against the gate when they are in[illegible] mitered position and before a[illegible] water is impounded behind the ga[illegible] The gates are so well balanced a[illegible] these springs function so perfec[illegible] that no jarring action is perceptib[illegible] at the instant of complete gate op[illegible] ing. White oak timber fende[illegible] mounted on the gates, serve as b[illegible] fers between gates and lock wa[illegible] White oak timbers, instead of t[illegible] originally specified rubber seals, a[illegible] also used at the bottom of the ga[illegible] to make a watertight closure agai[illegible] the miter sills.

Gate diagonals prestressed

Although the heavy steel bea[illegible] used as horizontal girders produce[illegible] fairly rigid gate leaf, additional p[illegible] visions were necessary to elimin[illegible] excessive torsional deflection dur[illegible] gate operations, resulting from [illegible] gate movements being propelled [illegible] only one strut attached near the t[illegible]

ach leaf. This was accomplished ttaching two sets of diagonals on downstream face of each leaf and tressing them after the gates were place. Diagonals extending up the pintle bearing are 6x1½-in. while those extending down the gudgeon pins are 8x1½ in. diagonals have large turnbuckles, they were prestressed by using a of jacks under the gate leaves at one-third points and throwing weight of the leaf on each jack, ending on whichever pair of diag- ls was being stressed. By using "Paul Bunyan wrench" on the buckle, prestressing of the diag- ls was completed.

Watertight emergency bulkheads

ach of the six 32-ton steel stop- forming the emergency bulk- ds that replaced the cofferdams two 5½-in. dia. cast-steel rollers nted in their ends to guide them nd down in the slots provided in lock walls. Two 18-in. dia. cast reaction rollers, mounted on the nstream face at each end, roll inst a grillage of 10-in. steel beams edded in the concrete walls, to sfer the reaction of the im- nded water to the walls of the

n section, the stop-logs are made wo plate girders spanning the full th of the canal, with girder webs ed horizontally. Flanges of the lers are made of 18-in. coverplates varying thicknesses. The girders 6 ft. 2 in. wide at the center of n. and tapered at the ends to fit the recesses in the walls. A ⅜-in. l skinplate on the upstream face vides a watertight bulkhead. The face is open, and drain holes are vided in the girder webs to per- easy submergence and with- wal from the water. Watertight- between the separate stop-logs is ntained through the weight of the bearing on a 1-in. untreated, soft, ded cotton rope between two uglas fir timbers near the front s of the assembly. An electrically- rated stiff-leg derrick with boom, unted on the canal walls, installed logs by means of a cable sling vided with automatic catch and ase mechanisms engaging cast- l lugs bolted to the top girder of h log.

ll contracts for constructing the Arthur Lock, complete with all dental work except the electrical

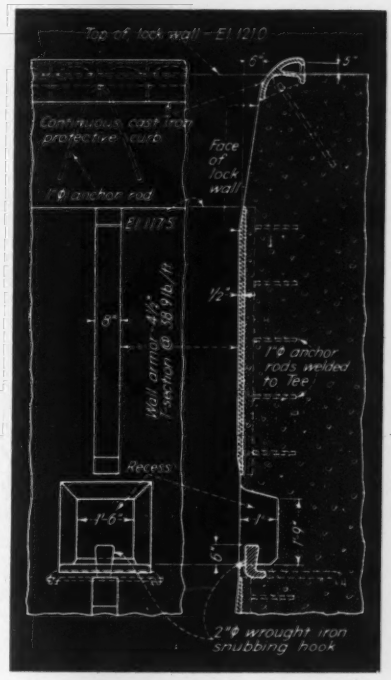


Fig. 9. Wall armor protection for the concrete walls during lock operation includes a continuous cast-iron protective curb at the top and steel T-sections embedded in the wall face. A partial section through the wall is shown at the right.

installation, were held by the Great Lakes Dredge and Dock Co., Chicago, which received the Army-Navy "E" award for successful completion of this huge project ahead of schedule. Included among the subcontractors that aided with the work were: The Speedway Construction Co., Chicago, excavating contractors; Milwaukee Bridge Co., structural steel; Brown and Kerr, waterproofing contractors, Chicago; Cleveland Builders Supply Co., concrete work; R. C. Martin Co., conduit installation; McDonald Construction Co., Sault Ste. Marie, construction of the control houses. Electrical installation was made by Harlan Electric Co., Detroit.

Construction personnel

All construction was under the authority of the Corps of Engineers, U. S. Army. Col. Paschal N. Strong, area engineer, supervised the work, assisted by Lt. Col. Milton E. Chamberlain. Other officers of the Corps of Engineers connected with the project included Col. Ralph G. Barrows, district engineer, Detroit, and Col. Ludson D. Worsham, division engineer, Chicago. Jack E. Harms was project engineer on construction, assisted by B. G. McCarthy. In May, 1943, Col. Strong was made district engineer at Detroit, replacing Col. Barrows who had been transferred to Chicago as division engineer. At the same time, Col. Chamberlain was made area engineer, while McCarthy was promoted to project engineer succeeding Harms who had been transferred to another project. Herman F. Rook, superintendent of the St. Marys Falls Canal and a veteran of 26 years with the U. S. Army Engineers, is the present area engineer.

Representing the Great Lakes Dredge and Dock Co. were J. A. Dubbs, vice president and manager of construction; Richard Beauvais, in charge of operations; V. Hart, engineer of construction; and R. Trotter, engineer in charge of concrete construction.

Fig. 10. Louvers in the lock floor open into laterals that connect with 11x14-ft. culverts in the side walls for filling or emptying the lock. Steel beams embedded in the walls and cast iron curbs at the top prevent abrasion of the concrete.

Postwar Public Works

Some Thoughts That Were Stimulated By an Australian Engineer's Report

James K. Finch
Renwick Professor of Civil Engineering
Columbia University, New York

IN A RECENT STATEMENT submitted to the Parliamentary Public Works Committee of Australia, Lewis R. East, chairman of the State Rivers and Water Supply Commission, and commissioner representing Victoria on the River Murray Commission, offers an analysis of the problem of postwar public works which should be of interest not only to government officials and to the engineering profession but to all intelligent citizens. As Mr. East points out, large-scale unemployment will be unthinkable in postwar days and, unless a reasonable and rational plan of postwar works is forthcoming, we will be carried into an era of frenzied finance by the great numbers of the public who believe that, in some mysterious way, national undertakings can be financed by "costless" national credit and the sky is the only limit to the expansion of all kinds of public works activities.

While Mr. East's entire statement is of interest, his two major theses are, first, that, no matter how a public work is financed, the public actually pays in man-hours and materials for all such works *at the time they are carried out*—no production is or can be borrowed from the future even if financed by loan. Secondly, that the real profits from desirable public works are seldom limited to their immediate and local use but, on the contrary, rest primarily on the increases in business, industrial, land, and other general economic values resulting from their construction. It is unreasonable to expect, therefore, that those enjoying the immediate benefits of such works should carry the entire burden of cost.

To those who have followed recent attempts to arrive at a sound and sane policy of public construction, these ideas are not new. Mr. East, however, carries his analysis forward with great clarity and follows it through more completely than any other recent author I have encountered.

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Labor and materials for public works cannot be borrowed from the future, hence plans for the postwar period must not include more non-productive public works than a nation's productive work can carry without a definite decline in standards of living. Financing postwar public works should include some means for assessing part of the cost against those who share in the large indirect benefits.

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It has been said, in connection with municipal public works, that the only limit to what may be undertaken as a collective enterprise in any community is the state of public opinion in that community as to what constitutes a public problem. As Mr. East puts it, "a community can have all the non-productive works which the returns from its reproductive works enable it to afford." The public, however, is entitled to full and clear information in regard to its expenditure for such works, and this is the first step to securing an intelligent public opinion on the desirability of a public undertaking.

This point has been argued in the past on the grounds that ultimately the cost of non-productive public undertakings must be borne by the surpluses of our general economy. It is also true, as Mr. East points out, not only that we have to feed, clothe and provide other requirements for those engaged on non-productive works, but that "the greater the proportion of the population so engaged, the less must be the proportion producing food and clothing and other consumers' goods and services and, therefore, the lower the standard of living." Thus:

> "If the object of postwar development is to raise the general standard of living of the whole community—and it should be—then it is essential that men should be engaged on non-productive works only to the extent that they cannot be employed on the production of consumers' goods and services, or on developmental works which, although temporarily non-productive, will, upon completion, result in the continuing production of new wealth."

A vital point in this statement is that concerning what Mr. East characterizes as "developmental works," presently but temporarily unproductive but destined ultimately to create new relationships and values and to produce new wealth. In Mr. East's use of the term "profitable," he implies that there is more to be gained as a result of proceeding with the undertaking than by refraining from or discontinuing the venture. With individual citizens, profit can be measured in terms of net interest returned. In public undertakings, the measure cannot be in such terms. Based on the assumption that state and federal revenues combined amount to approxi-

mately two-fifths of total annual production, it follows that a public work "is profitable if it results in a general increase in production amounting to approximately two and one half times the annual cost." Unless the return from public works is sufficient to thus offset costs, they can be financed only by diverting materials and labor from other works, both desirable and productive, or by penalizing, through taxation, non-governmental industries which have been established by private enterprise.

It is a mistake to assume, however, that benefits accrue only to the immediate users of the facilities or services. It is unreasonable, in irrigation works for example, to expect the irrigator to pay the full cost of water supply. The chief profits arising from such works are in increased business and other benefits received by other sections of the community. "It is estimated that of the gross receipts for an irrigator's produce, four-fifths are expended on the purchase of manufactured goods or on payment for services rendered by other persons."

This thesis was brought forward several years ago in connection with the financing of proposed rapid-transit facilities in San Francisco, by Alfred Brahdy and the late Robert Ridgway. It was expanded and developed in a paper by the former published in *Civil Engineering* in May, 1938, "The City Transit and Traffic Problem." As there pointed out, it is unreasonable to expect the fares collected from a rapid-transit facility to pay the entire cost of the facility. The abutting property owners, property and business in the area served, as well as the community as a whole, benefit by such construction.

Direct charges impractical

In short, while it is true that productive public works have been financed in the past by charges or assessments levied on those directly benefited, this plan is unfair, unjust, and will be impracticable in the future. The unearned increment, reflected in increased land values due to increased business opportunities and employment, should bear a major share of the burden.

Mr. East thus concludes that, in order to extend the range of practicable postwar public works projects, which extension will be essential to combat unemployment, it will be necessary to adopt some form of financial policy that will enable the capital costs of such works to be shared by the whole community. He makes no attempt to apportion such costs among the many who may benefit by these works but suggests, instead, a tax based on land values as a fair basis for the establishment of a public works fund by ear-marking the income from such tax and placing it in a general state or national development account. We may not agree with Mr. East in his apparent assumption that a more equitable apportionment of costs is impracticable, but he has, at least, offered a simple and direct method of financing public works. The problem still remains, however, of securing intelligent public support for really profitable works, using that term in the broad sense in which Mr. East uses it, and discouraging the useless dissipation of public funds on elaborately useless and ingeniously unprofitable public ventures.

Local Initiative Should Stimulate Our Postwar Objectives

The development of a program of postwar public works will miss an essential objective if there is a failure between the planning and construction stages to develop a local interest in, and civic responsibility for, the proposed improvements, stated Ernest Boyce, senior sanitary engineer, U. S. Public Health Service, at a recent meeting of the American Public Health Association.

The encouragement of local civic interest in public affairs, including public works, is so essential that the development of governmental procedures that will not only promote, but will require, this interest, may well be a basic objective in programming postwar activities. This will require an integration of the functions of local, state, and federal governments in the planning and development of public works in order to accomplish the program without a usurpation of responsibilities that should remain with local government, on the one hand, and an uncoordinated effort that would fail to provide a maximum national benefit, on the other.

A second major objective in the programming of postwar works may well be the development of procedures that will encourage the planning of projects sufficiently ahead of the construction period, and in such detail, as to permit a thorough understanding of the objectives to be attained. The development of a proper civic interest in proposed public works requires that there be a time interval between the design and the construction stage of a project to permit an educational presentation to the public of the need for the project.

Lesson from the past

As we study tomorrow's problems, Mr. Boyce pointed out, we recall the unemployment emergency of a few years back—and the popular demand for the immediate starting of public construction work. We should not forget that this emergency need for employment found us unprepared for the effective utilization of the manpower then available—and how the public works official was expected to do the impossible—to provide worthwhile construction projects without the guidance of adequate planning.

We are prone to envision programs of postwar public works against the background of a program that was designed to meet an emergency situation, continued Mr. Boyce. If our future public works programs are to be most effective in stabilizing a national reemployment situation, certain controls may be necessary to insure the scheduling of construction work at such levels of activity as may be necessary to avoid either a wasteful surplus or a shortage of the necessary supplies and labor. The postwar public works program will have failed in a proper objective if it functions only after an anticipated situaton has been allowed to become an emergency.

We may wait until dole-like contributions of federal funds are necessary to stimulate a sick domestic economy—or we may in government, as in public health, recognize that prevention is better than a cure, and provide funds for advance planning.

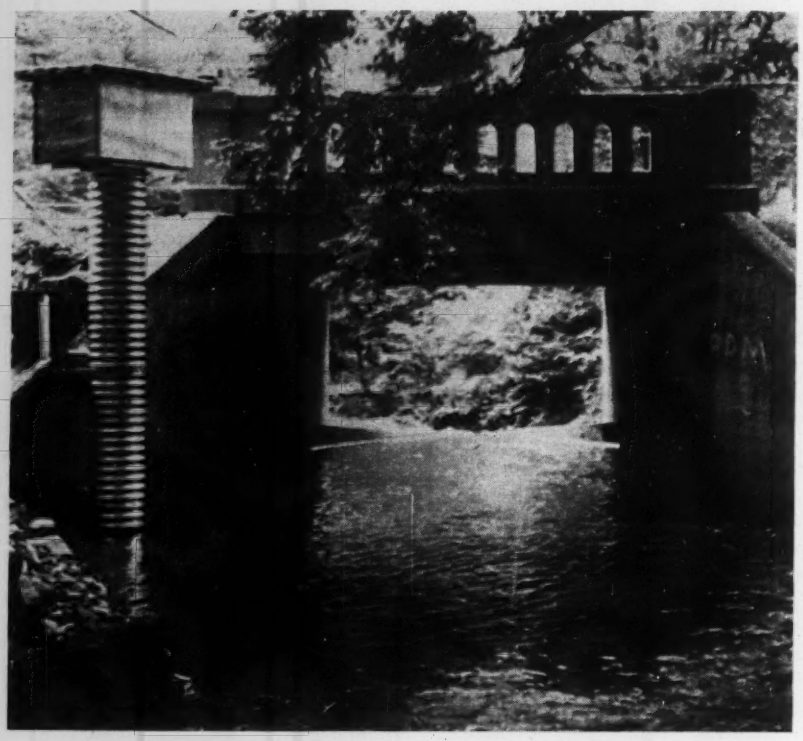


Fig. 1. Looking downstream at the new type gaging station installed in a highway culvert. The stilling pipe and recorder shelter are shown at the left.

New Type Gaging Station for Small Streams

James R. Villemonte
Assistant Professor of Civil Engineering, The Pennsylvania State College
Now Lieutenant (jg) USNR—on temporary leave

***Contents in Brief**—Based on model and prototype studies, a new type of gaging station for small streams has been developed. The measuring weir is created by installing two triangular-shaped sills on the floor of a culvert, a small space between the sills creating a throat. A stilling pipe supporting the level recorder is installed upstream. Rating curves are provided.*

A NEW, accurate and inexpensive gaging station for small streams has been developed at the Pennsylvania State College. The design is based on extensive model studies and an experimental installation measures the runoff from a 3.85-sq. mi. drainage area. Discharge characteristics of the models and the field installation would indicate that the station is accurate for a wide range of flows.

The field installation is shown by Figs. 1 and 2. The weir consists of two triangular, tapered, converging sills made of 2-in. creosoted planking, bolted to the concrete floor at a 30-deg. angle to the direction of flow. The sills butt against the vertical sides of the culvert and are 6 in. apart at the throat. The crests, of 3-in. radius, are removable. All of the joints are sealed with oakum.

The stilling pipe, which supports the water level recorder shelter, is connected underground to a sump 10 ft. downstream from the inlet and on the centerline of the culvert. The elevation of the culvert floor at the weir throat is used as the datum plane for recording the upstream water levels by means of a float-type automatic stage recorder.

For heads of less than 1 ft. the flow is through the trapezoidal section of the weir, and for heads of 1 to 2 ft. through a combination trapezoidal and flat V-notch section. In this range the entire flow is controlled by the weir with little loss in head. As the head is increased above 2 ft., the control gradually shifts from the weir to the converging wing walls of the culvert. As a result accurate measurement of the discharge over a wide range of flow is possible.

Model tests determine weir size

Proportions and size of the prototype weir were determined from several model studies, and the discharge characteristics of the culvert and gaging station were predicted from these tests according to Froude's law. Models built to linear scales of one-fourth, one-seventh, and one-twelfth were used.

Discharge characteristics of the culvert free of the weir were determined with the model built to a scale of one-twelfth. They are shown as Curve A of Fig. 3. Results of the tests on this same model fitted with experimental sills that had level crests and were slightly lower and wider at the throat than the sills finally adopted are shown by Curve B of the same graph.

Curve C of Fig. 3 was predicted from tests on models of the final design. This curve from Points 1 to 2 was determined from tests on a one-fourth scale model and represents the rating curve of the trapezoidal section; from Points 2 to 4 the curve was determined from tests with a one-seventh scale model. The rating curve of the combination trapezoidal, flat-notch section extends from Points 2 to 3. The shift in the control at the flow from the weir sills to the culvert entrance is illustrated by that portion of the curve between Points 3 to 5. Extension of Curve C from Points 4 to 5 was based on Curves A and B.

Equations for Curve C are as follows: From Points 1 to 2

$$Q = 4.36\,H^{2.2} \qquad (1)$$

and from Points 2 to 3

$$Q = 3.36\,H^{3.7} \qquad (2)$$

where Q is the discharge in cu.ft. per

sec. and H the head in feet measured from the culvert floor at the throat.

The field data are based on a series of 17 tests with discharge varying from 0.41 to 64.2 cfs. Work continued over a period of ten months and the data are in good agreement with predictions from the model studies. The percent of variation in the field discharge and those calculated by the above equations averaged 3.3 percent.

Effect of submergence on discharge

Effect of submergence on the discharge was determined by six series of runs with the model built to a scale of one-seventh. For each series the rate of discharge was held constant and the submergence was varied by changing the tail-water. The results are illustrated by Fig. 4, which shows the discharge for each test in terms of that for the prototype.

The point of transition from free to submerged flow is quite critical. A general rule can be presented for determining the discharge expected, namely, for submerged conditions and a head of 1.6 ft. or more, Curve 1 of Fig. 4 should be used, and for submerged flow and a head of 1.6 or less, Curve 2 is applicable. Curve 1 is more significant, since submergence is most likely to occur during greater flows.

The above rule is valid except when the submerged discharge persists between about 8 and 18 cfs. and the submergence between 60 and 95 percent. During these conditions the average error in computing the discharge will be between 5 and 7 percent. The maximum possible error is about 15 percent.

Curve 1 of Fig. 4 shows good agreement with Mavis' equation

$$\frac{C}{C_o} = 0.01\left[100 - 2^{0.2\,(p-70)}\right] \qquad (3)$$

where $\frac{C}{C_o}$ is the ratio in percentage of the submerged to free discharge for the same head and p is the percent of submergence.

Conclusion of work

Results of the investigations with the new type control station justify the following conclusions:

1. Rating characteristics of the weir can be determined within practical limits by model analysis. The rating curves are not complex.

2. Weir sills are simple in design and construction. They can be installed in existing drainage structures without encroaching appreciably upon the effective area of the waterway.

3. The throat of the weir will not clog easily with debris, silt or gravel. Thus, consistent and stable rating characteristics with a minimum of maintenance cost can be expected.

4. Adaptation of the weir to streams of varied size is feasible. The flow expected, 90 to 95 percent of the time, should influence throat width and sill height, but the height will also depend on the size and design of the inlet of the drainage structure.

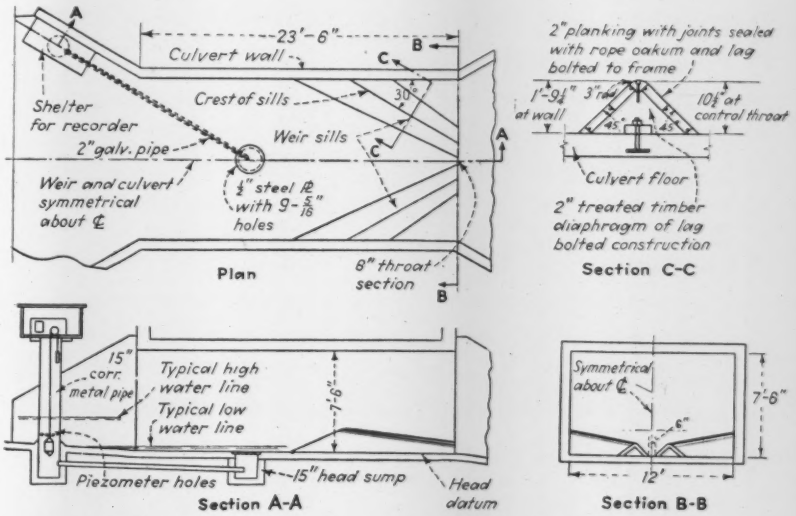


Fig. 2. Field installation of new gage was made according to above plans.

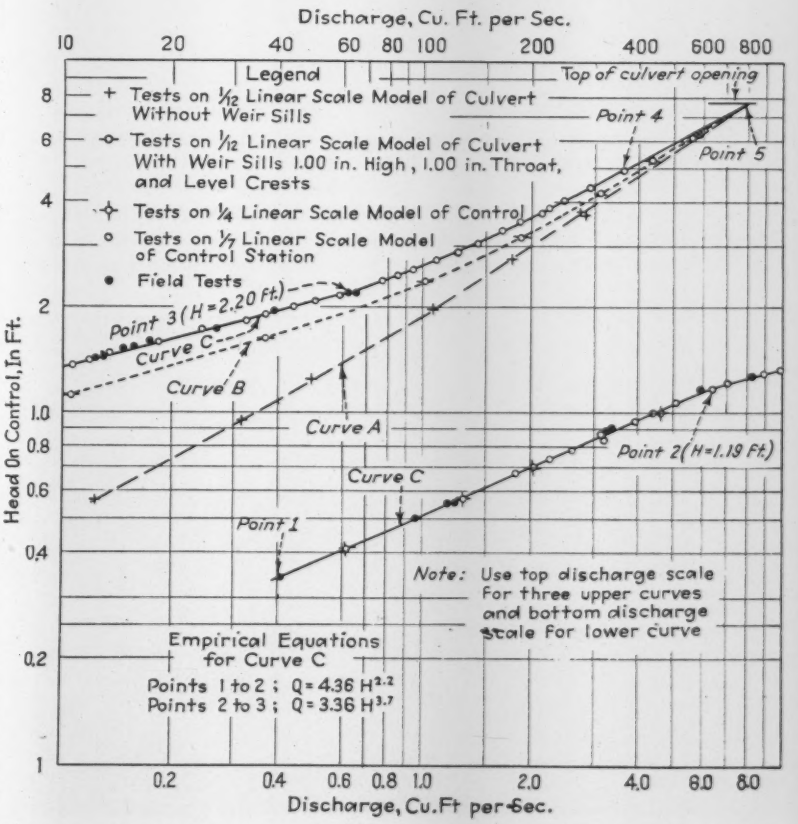


Fig. 3. Rating curve for new control station for a wide range of flow. Curves are based upon both model and prototype measurements, which conform closely.

Where no existing drainage structures are available, the sills may be constructed on a paved portion of the stream bed between either vertical or sloping abutments.

5. Best operating results will be obtained when: (a) Angle of sills with reference to direction of flow is 30 to 45 deg.; (b) up and downstream faces of sill are at an angle of 45 deg. with the horizontal; (c) crests of the sills have a slope of one vertically to eight or ten horizontally and are rounded to a 3-in. radius or greater, and (d) permanent installations are constructed of concrete.

The work described is part of a hydrologic study initiated by and under the direction of F. T. Mavis, head of the department of civil engineering at the Pennsylvania State College.

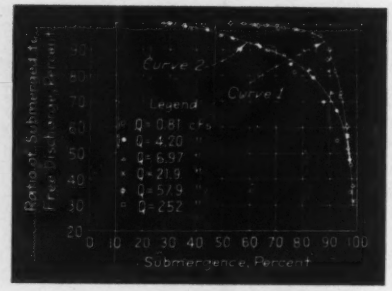


Fig. 4. Effect of submergence for various discharges for full scale gaging station. Curves are based on tests of one-seventh linear scale model.

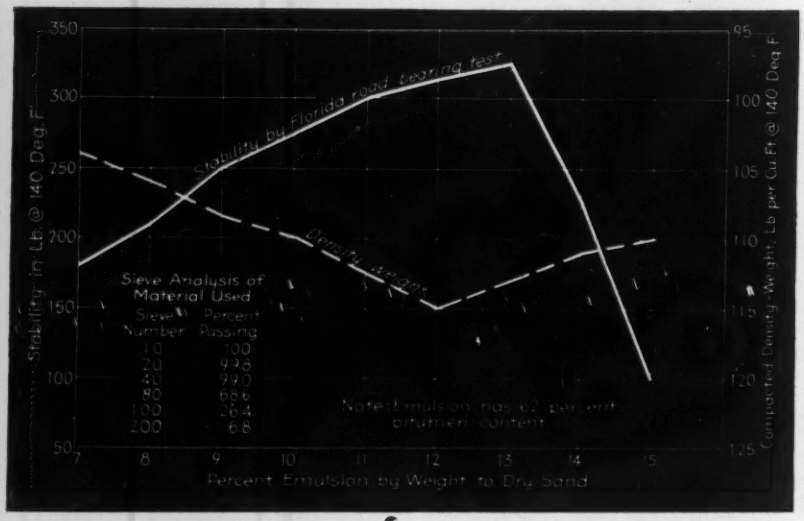
Better Testing Methods for Emulsified Asphalt-Sand Paving

John S. Doran **L. Harold Wilson**

Associate and Junior Airways Engineers Respectively
Beaufort, S. C.

Work in connection with the Beaufort, S. C., airport project to evaluate density and stability of emulsified asphalt-sand paving in place has resulted in development of what is considered an advanced testing technique. The test work was conducted in the laboratory at the airport to determine the quantity of emulsified asphalt to be mixed with local material on the site in order to obtain maximum stability and density. The test gives a true picture of the most satisfactory quantity of emulsion to be used with the material available.

As is shown on the accompanying graph, the test was run by using from 7 to 15 percent of emulsified asphalt. It was found that at least 12 percent moisture was needed to obtain uniform dispersion of the asphalt in the sand. The maximum stability and density for the local material found on this project was reached when the material was mixed with 12 percent emulsified asphalt of 60 percent bituminous content.


Stability by Florida road testing test
Density
Sieve Analysis of Material Used
Sieve Number | Percent Passing
10 100
20 99.8
40 99.0
80 68.6
100 28.4
200 6.8
Note: Emulsion has 62 percent bitumen content
Stability in Lb @ 140 Deg F
Compacted Density Weight, Lb per Cu Ft @ 140 Deg F
Percent Emulsion by Weight to Dry Sand

Variation of density and stability of soil used for Beaufort, S. C. airport pavement work with percent of emulsion.

The test procedure follows:

1. A given percentage of asphalt is mixed with the sand by a mechanical mixer.

2. When the mixing is completed, the sample is placed in a drying oven and dried to constant weight at 140 deg. F.

3. The mixture is then tamped in thin layers in a 3-in. dia. cylindrical mold 3 in. high. When completely full the mold is placed in a compression machine and the material compressed until the specimen firmly supports a total load of 20,000 lb.

4. After initial compaction the mold is placed in the drying oven and left for 2 hr. at a temperature of 140 deg. F.

5. Immediately upon removal from the oven the mold is placed on the testing machine. A cylindrical plunger of exactly 1-sq. in. bottom area is placed at the center of the sample at the top and a load applied in accordance with the Florida State Road Department test procedure for determining the stability of treated sand. (This procedure is outlined on p. 508 of the Proceedings of the December, 1941, annual meeting of the Highway Research Board.) The load is increased until a deformation of 0.1 in. is reached. This load is recorded as failure and is considered the greatest load in pounds per square inch which the sample can support at the given temperature.

6. After completion of the stability test, the same mold is calibrated for volume and the material tamped into it as before at the same temperature and the same compression, care being taken to trim the treated material exactly to the level of the top of the mold. The combined weight of the sample and the mold is taken and the weight of the mold subtracted to give the weight of the sample. The volume of the mold is already determined, thus permitting the density of the sample to be calculated.

This test procedure is considered of value to engineers.

Notes on the Public Works Congress

● Two major fields of public works activity dominated the forty-ninth annual congress of the American Public Works Association held at Chicago October 24-27. One was related to the emergency operation of municipal facilities for war-expanded communities, and the other dealt with definite planning of public construction for the immediate postwar period. Extracts from the papers presented at the technical sessions of the conference are given in the following. A news account of the meeting, together with the names of the new officers of the association appeared in *ENR*, Nov. 4, p. 660. One paper on the sanitary fill method of waste disposal used by the Army will be reported fully in the December 2, issue.

Water and Sewage Treatment

DURING THE WAR PERIOD there has been a tendency toward the use of manufacturers' designs and patented equipment in the construction of water purification and sewage treatment plants. This resulted from the desire to place work under contract quickly, the relaxation of usual governmental practice in requiring advertisements for bids on plans and specifications that will permit rigid comparison of bids, and to some extent on the energy and enterprise of salesmen. If this practice of using "shelf hardware" is continued year after year it is certain to result in decreasing the quality of design, and is also likely to result in mistakes.

It has become apparent through experience at a number of places having strong sewage such as Sioux Falls, S. D., Austin, Minn., and other places that a strong sewage cannot be handled readily by a single stage secondary process. Where standard trickling filters are used, these clog rapidly. Where activated sludge is used, bulking of the sludge occurs and prolonged periods of aeration are required. This is now being overcome by preliminary treatment or what might be called "roughing filters." These are not new but the concept of their operation and loading has been improved by experience with so-called high-rate filters.

The merits as to economy and efficacy of two-stage trickling filters is still to be determined. Also to be further studied is recirculation of effluent in connection with high-rate filters. That such recirculation has merit is clear; but its economy as compared with simple high-rate filtration is not as yet apparent. In the United States the trend seems to be toward two-stage treatment in shallow trickling filters with elaborate provision for recirculation as well.

It is highly desirable to utilize the experience now being gained in the full sized operation of a number of devices in both the water supply and sewage treatment field now being used for cantonments, ordnance work, and other governmental establishments, not only for possible future wars but also for peacetime practice following the present war.—*Paul Hansen, Greeley and Hansen, Engineers, Chicago, Ill.*

Wartime Congested Areas

Many cities throughout the United States have experienced sudden large increases in population without corresponding increases in community facilities such as garbage collection, water supply, transportation, shipping and recreation facilities. In the normal growth of cities before the war there was a definite relationship between money spent on residential construction and for these facilities. Up to 1940 this ratio was $3.00 for residential construction for every $2.00 spent on community facilities.

In 1941, although new housing had to be provided in war production areas, the tremendous demand for steel, copper, aluminum and lumber made impossible the construction of enough commercial services and recreational facilities. The result was that for every $4.00 spent on new housing, $1.00 was spent on new community facilities and that ratio has been moving farther apart ever since. In 1942 it was 5 to 1 and this year it is 7 to 1.

Since the establishment last April of the Committee for Congested Production Areas, headed by Corrington Gill, considerable progress has been made in the handling of governmental problems in congested production areas. Principal objectives of this committee is the maintaining of a maximum of production throughout the country by quickly solving acute problems that may arise in communities both large and small. These problems cover a wide range and may include a sudden shortage in the supply of certain foods, a local coal shortage, the need in many communities for adequate schools, hospitals, venereal disease treatment centers, child care facilities, as well as additional movie theaters, grocery stores and restaurants.—*Willard F. Day, liaison officer, Committee for Congested Production Areas, Washington, D. C.*

Fort Worth, Texas and the immediate surrounding area is truly a congested war area. This is occasioned by the location there of many war industries, several air training schools, a naval air base, the Fort Worth Army Air Field, the Eagle Mountain Naval air station and shell manufacturing plants. These war activities have caused a 25 percent increase in the city's metropolitan district, resulting in many difficult problems of municipal management. The amount of water required daily has more than doubled in the past three years and the problem of overloaded interceptor mains as well as a heavily overloaded sewage disposal plant has been indeed serious. There are at present 6,000 lin. ft. of 48-in. sewers under construction to partially relieve this situation. The city also has placed in operation its first sani-

tary sewage lift station which includes two electric pumps each with a 1,750 gpm. capacity.

Construction by WPA of a number of access streets and roads to the nearby Consolidated-Vultee plant, as well as reconstruction of the municipal airport was started early in the war period. Completion of this work got so far behind schedule that it was necessary to use all available street maintenance equipment in its presecution, with a resulting negligence in street maintenance that will be felt for several years hence.

The WPA project at the municipal airport was a headache from the beginning and little progress was made before the WPA was eliminated from the picture. Runways at the airport are now being reconstructed by contract under supervision of CAA.—*W. O. Jones, Director of Public Works, Ft. Worth, Tex.*

Airways of Tomorrow

The impact of three million men of our armed forces, trained in some work connected with aviation, suddenly returned to civil life is a potential situation that calls for serious thought. Never in the history of our country have so many men been trained at public expense to work in a single field of transportation. This certainly will contribute much impetus to aviation's advance and it will demand public works to accompany a rapidly increasing civil use of the airplane.

To quote W. A. Patterson, president of United Air Lines, "Acceptance of the airplane by the public has been advanced twenty years by this war and our penetration of the potential market in the postwar period will be considerably faster than prior to the war. We can foresee a growth five times that of our best prewar year within four years of the war's end."

It is possible that public works plans now in blueprint form in some of the offices throughout this country may be scrapped. It is conceivable that a better understanding of the ability of the transport airplane could cause the scrapping of certain projected waterway improvements, could bring about the cancellation of plans for some tunnel work, could bring about a review of plans for some exceedingly costly highway and bridge construction in some mountainous states.

Predictions of this sort from men of long experience in air transportation may well put on the alert men in the field of public works. There will be demands from manufacturers and owners of personal airplanes, from fixed base operators of airplanes for hire and from those who will need airplanes for agricultural, mining and industrial enterprise in heretofore inaccessible places.

Aviation of tomorrow will, undoubtedly, lend itself to diversified application in the transportation picture of our vast country. Next to a strong advance in volume of service and a lowering of rates on our scheduled air services, the air-minded man returning from the war will want airplanes available for purchase, for hire, for charter in connection with the normal activities in the usual radius of his life's activities.

While the prospect of global flying catches the headlines, is new, dramatic, and is highly important as our postwar foreign policy takes shape, the broadening use of the airplane at home and the extension through public works of the airway and landing facilities at home in every county and in every state is what our returning airman will want first. It is achievement at home that makes the American way of life for which we are proud to fight.—*Cyril C. Thompson, vice president, United Air Lines, Chicago, Ill.*

Discussion:—If the growth of air traffic even approaches the figures indicated in a number of forecasts which have been made by competent authorities, we will have a job of planning ahead of us which will tax our ingenuity as well as the ability of our political units to provide funds to finance the facilities needed for the accommodation of these planes and passengers.

In selecting sites for commercial airports, great weight must be given to their accessibility to center of the city. This does not mean necessarily that the fields must be immediately adjacent to the urban area, but that they must be so located that the travel time to the downtown section will be cut to a minimum. Neither should we lose sight of the fact that there may be need for several satellite fields around the larger cities which will serve the residents of rural areas supporting the metropolis. These facilities will be needed for private flying in the local areas, for commuting to and from the city, and for shuttle-service from the main airport to the lesser communities.—*Nathan L. Smith, chief engineer, Department of Public Works, Baltimore, Md.*

Highway Maintenance Problems

This country's wartime highway traffic pattern has affected a very limited mileage of city streets and rural highways. But these routes are the very ones that in normal times carry the bulk of traffic, and generally they are among the oldest streets and roads we have. A combination of factors is destroying these key roads at an alarming pace. Most of them are 15 to 20 years old, and were at the end of their useful life when the war began. Wartime stoppage of normal construction prevented their rebuilding, and wartime maintenance difficulties curtailed even the upkeep program. Add to that the fact that today's traffic is made up far more than usual of heavily laden trucks and military convoys, and the pounding on this concentrated net of war streets and roads takes on an even more serious meaning.

Maintenance officials hope to rely on labor-saving equipment in the coming months to meet their present manpower shortage, but that means getting repair parts and new equipment. They can get priorities, but these are only hunting licenses today. The real problem is to locate the parts and equipment. Unless repair parts can be found quickly, much essential equipment will be laid up this winter. The need seems clear for WPB approval of some equipment and parts manufacture, and even then, there is a serious shortage of repair mechanics in maintenance divisions.

The winter neglect of road maintenance also means trouble during the spring thaw. Snow not removed promptly soaks the road base with disastrous results following in the spring. The shortage of snow plow blades is causing increased use of the practice of leaving an inch of snow on the road to avoid wearing out the blades; a practice that may be expedient but far from desirable.

In the design and location of primary traffic carriers, we must call increasingly on the knowledge of our traffic engineers and city planners. Although tomorrow's expressways will carry the concentrated traffic bands, that mileage will be very lim-

ited. There is much that can be done on secondary and tertiary arteries to permanently improve their safety and efficiency. We must build these features into the street and highway design. We must make it hard for a driver to commit a fault, in contrast to today's conditions, where the slightest error in judgment can mean a fatal accident.

These are the opportunities that deferred construction and reduced maintenance, have given in our future public works.—*G. Donald Kennedy, vice president, Automotive Safety Foundation, Washington, D. C.*

Planning Public Works

To attempt to solve the general problem of unemployment after the war by government subsidized public works program alone not only would be unsound but would indicate a complete lack of understanding of the magnitude and scope of the problem. In fact, to make such a program our first line of defense against unemployment would be an open admission that no longer are we placing our faith in the system of free enterprise.

Following the termination of the present conflict there is apt to be a critical and serious problem of employment. The key to the permanent solution of this problem, however, lies in the maintenance of full production, and thus full employment. Industry should, and must, be given every assistance in its effort to achieve this objective.

On the other hand, if industry, during the period of reconversion, cannot take care of those seeking jobs, then some other means must be found to solve temporarily the question. It would indeed be a stinging indictment of our democratic system, if we were able to provide full employment during the time of war, but had many millions unemployed during the time of peace. It would be a worse indictment if we resigned ourselves to the idea of taking care of these unemployed by relief, dole or a synthetic public works program.

Occasionally we are confronted with the statement that government should keep hands off and that industry alone can solve the problem. Those that make this statement are simply shutting their eyes to the facts that are placed before them. Indications seem clear that there will be a short period during the reconversion of industries to peacetime production when some temporary provision should be made to throw public construction into the breach.

There are many other factors which indicate the magnitude of the problem which will have to be met after the war. It is estimated that one half of our national income is involved in war contracts. The impact on this national income by the cancellation of these contracts will be tremendous. We cannot expect that workers who are thrown out of work because of the cancellation of these contracts can immediately be absorbed in an industry furnishing consumer goods, for which many believe there will be a tremendous demand. A program of public works projects, in order to stimulate industry and to provide employment during this reconversion period, is no more than an insurance policy against a disastrous depression.

When war broke out the State of New York was in a somewhat favorable position as far as public works plans were concerned as it already had legislative authority to progress a substantial public works program. Construction funds for a large proportion of this program has been provided. Since that time, the program has been enlarged.

The present status of this part of the program is: Grade crossing eliminations, $95,000,000; highways, parkways and throughways, $200,000,000; housing $80,000,000; state buildings, parks, etc. $20,000,000; barge canal $5,000,000; totalling $400,000,000.

Over $200,000,000 of this provision has already been made for construction funds provided mainly from the sale of bonds. Plans for these projects are being designed by the state department of public works, as well as by other state departments. Railroads are preparing plans for many grade crossing eliminations, and individual housing authorities have let contracts to private firms for the design of housing projects.—*Holden A. Evans, Jr., executive secretary, New York State Postwar Public Planning Commission, Albany, N. Y.*

Municipal Planning Progress

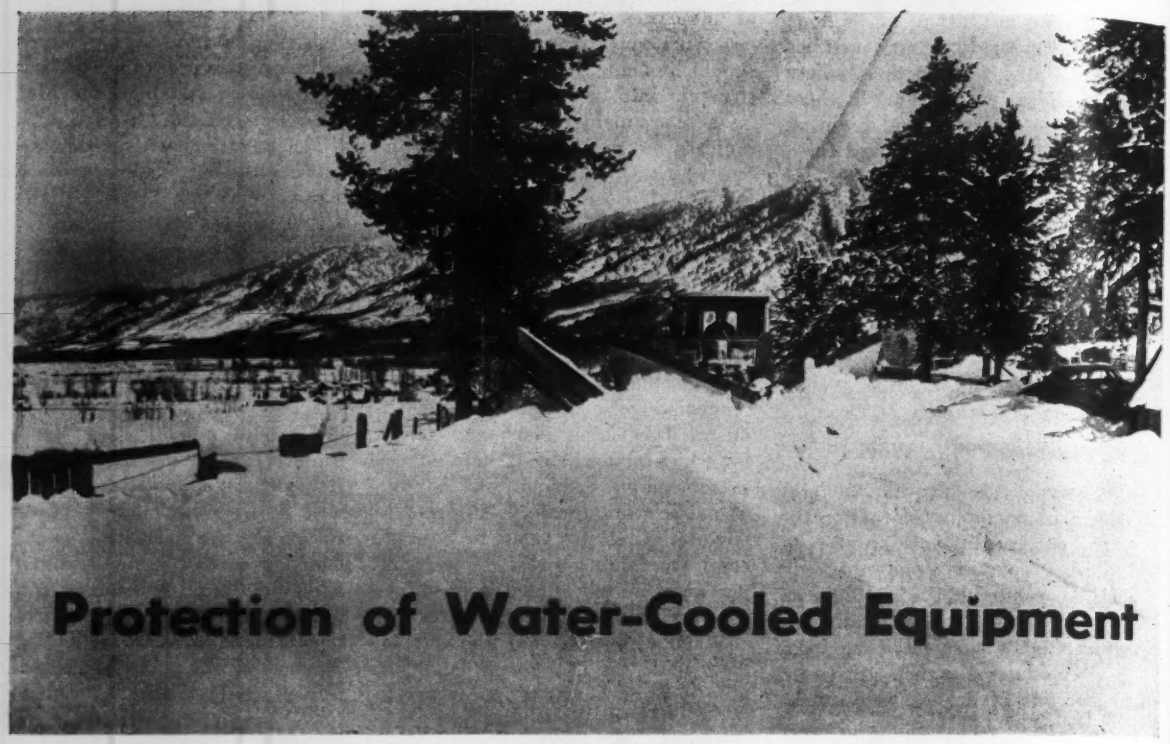
Any municipality, large or small, should formulate a coordinated program which envisions improvements for its future development to eliminate confusion and overlapping; economy thereby being effected. There is no excuse for any municipality to fail to plan, as planning requires no strategic materials nor priority ratings.

The master plan is a set of recommendations. It is flexible and functions by a process that carries on from day to day, year by year, adjusting its objectives to the changing needs and new technology. This master plan is a basis for the official plans that legislative agencies and commissions finally adopt. One essential consideration of the master plan must be with border problems between neighboring communities such as the interlinking of highways, transportation, public utilities, parks, playgrounds and zoning. These problems must be jointly considered and planned.

A 5-year tentative public works program has been laid out for the development of Brookline, Mass., in accordance with a master plan and programmed and budgeted within the town's ability to finance without borrowing or with as little borrowing as possible, without any thought of federal grants, but flexible enough to allow necessary corrections as conditions change.

As to blighted areas, this city plans to eliminate one of its older sections by taking the property by eminent domain and constructing a fire station, central alarm building and a general fire department repair building. In every community, however, an important problem for planning boards is to plan a program for rejuvenation of blighted areas. The only method by which this can properly be done is by total or partial demolition of the area and its corresponding reconstruction.

Prefabricated or packaged houses probably will be a revolutionary postwar change and offers a serious threat to the status quo of land and home development. It has many ardent and persuasive adherents, united in the belief that such building is the economic and efficient solution of the postwar home shortage. The responsibility of city planners is to see that this type of low cost construction does not bring forth hit or miss unplanned developments which destroy the structure of our municipalities.—*Walter A. Devine, town engineer, Brookline, Mass.*



Protection of Water-Cooled Equipment

***Contents in Brief**—Approved anti-freeze solutions are available for truck and industrial use but conservation must be practiced to cover essential needs. Ethylene glycol solutions give the best protection as they increase rather than decrease the boiling point of the solution as concentration increases and they have a lower thermal expansion. Do not use salt or petroleum base solutions and do not mix types of anti-freeze.*

TWO TYPES of government-approved anti-freeze protection are available for construction machines. They are ethylene glycol (the base of anti-freezes such as "Prestone") and ethanol (denatured ethyl alcohol). Ethylene glycol probably gives the greatest anti-freeze protection on the basis of all-winter reliability and cost.

As a guide for selecting the type of anti-freeze best adapted to cooling in any particular vehicle it should be remembered that the boiling points of ethanol type solutions are lowered with increase of concentration and freezing protection, while in the ethylene glycol type the boiling point rises with higher concentration and increased freezing protection. In the freezing protection range of +10 deg. to —20 deg. F., the boiling point of ethylene glycol solutions are 28 deg. to 43 deg. higher than the alcohol solutions.

Both ethylene glycol and ethanol anti-freeze products are commonly distributed in concentrations of 94 percent to 99½ percent. The boiling points of concentrated products should not be confused with the boiling points of the commonly used solutions, which rarely exceed 50 percent concentration even in the coldest areas of the country. Alcohol solutions cannot usually be used with thermostats opening at 160 deg. F. or higher, unless the cooling system is equipped with a pressure valve or surge tank.

The boiling point of water and anti-freeze solutions drops about 2 deg. F. for each 1,000-ft. rise in elevation, which of course increases the possibilities of boiling and overflow loss with high altitude driving. On the other hand, radiator-cap pressure valves in sealed cooling systems raise the boiling point. For example, in an air-tight system with a pressure valve, that opens at five pounds pressure, the boiling point of the cooling liquid may be raised 13 to 15 deg. F.

Both water and anti-freeze solutions expand when heated, making it necessary to leave adequate air space in the radiator, with the liquid cold, to avoid overflow losses from thermal expansion at driving temperatures. Ethanol and ethylene glycol anti-freeze solutions expand somewhat more than water. Total expansion may be a quart or more in a 4 gal. capacity cooling system, as indicated in Table 2. The cost of anti-freeze, and its scarcity during the present emergency make it imperative that expansion losses from overfilling of the radiator be avoided.

Anti-freeze testers

Testers for anti-freeze solutions are of many types but the most elaborate cost less than $6 retail. Expense of ownership is insignificant in comparison to damage that may be done by freezing of equipment. Where only one type of anti-freeze is used by a fleet the single solution tester is recommended, to avoid possibility of human errors. Commercial testers have built-in thermometers and quick reading scale to accurately determine the freezing protection at any temperature from about 60 to 160 deg. F.

Simple testers are available calibrated for the two recommended anti-

freeze solutions, alcohol and ethylene glycol. These are the testers commonly found in filling stations.

Another tester will test anti-freeze having a basic solution of alcohol, methanol or ethylene glycol of which there are over 100 solutions sold under various trade names. Accurate reading can be quickly learned but some mental effort is required for its proper interpretation.

Accuracy of an anti-freeze tester may be easily checked by use of a solution of known freezing protection. For instance, a solution of one-third ethylene glycol anti-freeze and two-thirds water gives zero protection, and a 50-50 solution protects to —34 deg. F. Check the tester for accuracy with solutions at different temperatures within the range of the thermometer scale.

Creep and corrosion inhibited

While water itself is chemically very stable, it attacks certain cooling system metals quite vigorously under the influence of heat and aeration, conditions constantly present during cooling system operation. Therefore, the cooling liquid, whether water, or water solutions of anti-freeze should contain a corrosion preventive if metal attack and rust formation are to be avoided.

Uninhibited anti-freeze liquids have some tendency to loosen rust and creep through rust-filled crevices in the cooling system which previously have been plugged leaktight when using only water. Leakage-rate tests in laboratory apparatus and in vehicles have shown that this is particularly true of untreated ethylene glycol solutions. However, in present day ethylene glycol products containing inhibitors, the leakage rates of solutions have been found to be substantially lower than that which occurs with water alone.

Inhibitors contained in standard organic anti-freeze products greatly reduce the attack of water on metals, and also stabilize the anti-freeze materials chemically, so that effective corrosion prevention can be maintained in a normal cooling system for at least one anti-freeze season. The reduction in the corrosion of iron is particularly outstanding, and the indicated protection to aluminum, copper, brass and solder by inhibited anti-freeze solutions indicates overall economy in the use of summer rust preventives with water as well as the use of suitably inhibited anti-freeze.

Corrosion inhibitors in anti-freeze may be weakened and exhausted by extended or hard use. Such variables as driving mileage and speed and the condition of the engine and cooling system are important factors in the non-corrosive service life of solutions. Contaminated anti-freeze solutions with exhausted inhibitors may cause more corrosion and rust formation than untreated water.

In normal times the ideal procedure is to install a fresh filling of corrosion inhibited anti-freeze each season but for the duration of the war it is essential to save such critical materials whenever possible. It is, however, just as important to prolong the life of cooling system parts, and for this reason the continued use of anti-freeze solution that may be corrosive should be avoided.

If the anti-freeze is a deleterious salt or oil type it should be drained and discarded and the cooling system thoroughly cleaned and flushed. If the solution is either of the approved types, ethanol or ethylene glycol, it should be first checked for strength. Very weak solutions may not be worth saving.

After draining the solution into clean containers, clean the radiator by flushing with water, soda, a good kitchen cleaner or a prepared radiator cleaner as condition dictates. For summer driving refill the radiator with water with a suitable rust inhibitor added, tightening all hose clamps and connections and checking for leaks.

Anti-freeze solution suitable for further use should clear up upon standing, or settle out practically water-white or with a trace of the original color. If the solution has become brown or rusty and fails to clear on standing it should be discarded. If the solution is to be stored, use

AN 8-POINT ANTI-FREEZE PROGRAM

The following suggestions are made for installation, testing and servicing of anti-freeze solutions.

Perform any necessary services to insure that the radiator is clean, leaktight and in proper working order.

Drain the system by opening all cocks and plugs on engine and radiator. Use a cleaning solution, if necessary, at least flush thoroughly with water.

Determine the quantity of anti-freeze to use, from the vehicle's capacity and the anti-freeze manufacturer's protection table, for the lowest temperature likely to be encountered.

Pour solution into the radiator and finish filling with water, but only to a level that will allow for thermal expansion without overflow.

Run the engine until it reaches thermostat temperature, to completely mix the water and anti-freeze. This will prevent a slush ice freeze-up in extreme cold weather and will remove air trapped in the engine, after which it may be necessary to add more water.

Especially in heavy-duty engines, it is necessary to inspect the solution and test for freezing protection at least once a week. Always make the test before adding anti-freeze or water, and with the solution warm. Carefully follow the instructions furnished with the tester.

Replace leakage and overflow losses of solution with a mixture of water and anti-freeze to give the same strength as the original filling.

In case of insufficient protection, or diluted solution, use the table or chart supplied by the anti-freeze manufacturer to calculate the amount of additional anti-freeze needed.

TABLE I.—FREEZING AND BOILING POINTS OF ANTI-FREEZE SOLUTIONS

Percent Volume in Water		Freezing Point	Boiling Point Deg. F.	
Ethylene Glycol	Ethanol	Deg. F.	Ethylene Glycol	Ethanol
20	22	+16	217	189
25	27	+10	218	187
30	32	+4	219	185
33	35	0	220	184
40	43	−12	221.5	182
44	48	−20	223	180
48	55	−30	225	179

TABLE II.—PINTS THERMAL EXPANSION PER GALLON OF LIQUID BETWEEN 40 DEG. AND 180 DEG. F.

Water.....0.24 pint per gallon

TYPE OF ANTI-FREEZE	SOLUTIONS PROTECTING TO		
	+20 deg. F.	0 deg. F.	−30 deg. F.
Ethylene Glycol	.29	.34	.37
Ethanol	.31	.47	.54

clean, labeled and sealed containers, preferably glass or earthen ware. Before the stored solution is returned to the cooling system in the fall, it should be tested again for anti-freeze strength. Special re-inhibitors made and recommended by reputable manufacturers are available and should be added to prevent rust and corrosion. If it is necessary to increase the freezing protection, fresh material, preferably of the same brand, should be added.

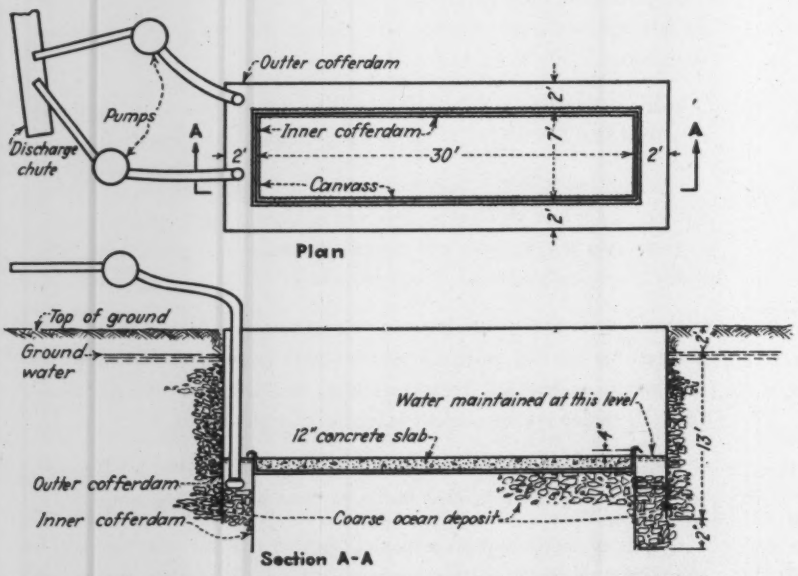
The mixing of different brands of anti-freeze in the cooling system should be limited to those having the same basic materials, such as ethylene glycol or ethanol. Anti-freeze value of ethylene glycol mixed with ethanol cannot be correctly determined with a commercial anti-freeze tester.

Canvas Lining for Cofferdam Controls Water in Pervious Soil

M. N. Donegian
Associate Civil Engineer, U. S. Coast Guard
Seattle, Wash.

Uncontrolled flow of water into a cofferdam built for construction of the foundations for a gasoline fueling station at a U. S. Coast Guard Station was overcome by the placing of concrete on a waterproof canvas used to form an inner lining for the sides and bottom of the cofferdam. Cost of the second-hand tarpaulin used for a cofferdam 7 by 30 ft. in plan was but $6. The concrete was of excellent quality, indicating that the method used may have wide application in pervious foundations.

A supporting slab was required about 10 ft. below the ground surface and 8 ft. below the water table in a coarse and very pervious ocean deposit. A wood box cofferdam was constructed using 2x6-in. T&G sheathing about 15 ft. long and driven vertically to well below the necessary unwatered depth. Heavy flow into the cofferdam made it impossible to unwater the area and a second cofferdam 2 ft. smaller on all sides was constructed inside the first, as shown by the accompanying drawing. Again 2-in. sheathing driven vertically was used and it extended 2 ft. deeper than the exterior cofferdam. The interior cofferdam reduced the displacement and movement of the material within the enclosed area and probably prevented collapse of the outer cofferdam, but it did not cut off the flow of the water. One 6-in. pump and one 4-in. unit with a combined capacity of 130,000 gal. per hr. were able to reduce the level of the water to about 4 in. below the top of the inner cofferdam but could not dry the pit to the foundation level.



Lining the inner of two cofferdams with a canvas tarpaulin sufficiently large to cover the foundation area as shown above ended trouble from water in building the concrete mat for a gasoline fueling station.

At the writer's suggestion the contractor covered the area bounded by the inner cofferdam by a tarpaulin sufficiently large to also line the walls of this enclosure. Placing of the concrete started at the end farthest from pumps and as the concrete was added it pushed the water beneath the canvas to the sump. Not even a milky discoloration was noted in the water outside the canvas. The pumps continued to operate for 24 hr. after the concrete was placed to prevent, so far as possible, salt water coming in contact with the concrete.

A 1:2:3 concrete was used, an additional bag of cement per cubic yard of concrete being added to counteract the effect of any salt water which might penetrate the tarpaulin. Quality of the concrete was excellent. Thus, successful use of the canvas for the job described would indicate the method to be of value for much similar work.

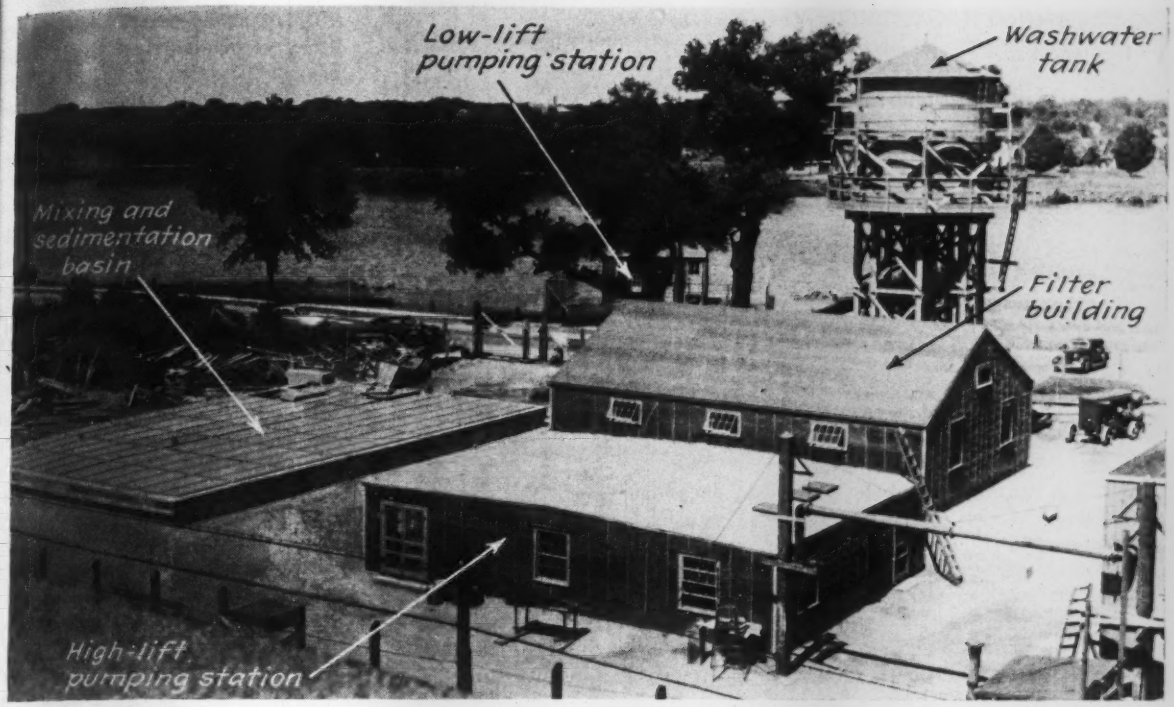


Fig. 1. Buildings for plant are theatre-of-operations type of construction. Source of supply is stream in background.

Water Plant Built of Available Materials

Harry L. Kinsel
Design Engineer, Metcalf & Eddy, Boston, Mass.

***Contents in Brief**—Water treatment facilities for an ordnance plant were designed and constructed in three months with such materials as could be readily obtainable under present war conditions. Buildings are of timber-frame, theatre-of-operation type. An elevated 25,000-gal. water tank to store washwater is of timber construction. Because they were available, deep-well units were used for both low-lift and high-lift pumping.*

USE OF SUCH MATERIALS and equipment as were readily available under war conditions makes construction of the water-treatment plant for a large ordnance project of interest. The facilities also are noteworthy because of the speed with which the plant was designed and constructed, the plant going into operation four months after the consulting engineers were notified to proceed with preparation of plans.

The project was constructed in an eastern city where the capacity of the existing municipal water-supply facilities were so limited as to make it necessary to build a new plant to provide process water for the ordnance works. Test wells showed that the groundwater supplies were inadequate. Therefore, a nearby river was selected as the source of supply. Total requirements were to be 1.5 mgd.

Three types of plants were considered. These were: (1) A slow-sand filter plant using the foundation walls of an abandoned streetcar barn for the walls of the filter bed; (2) a pressure filter plant using second-hand steel pressure filters; and (3) a rapid-sand filter with open-gravity filters. The first plan, when necessary land purchases were included, was considered too costly. Construction costs for the second plan were estimated to be slightly less than for the third plan or the rapid-sand filter installation, but the latter was adopted because of the better control over plant operation which it provides.

The facilities provided consist of: A low-lift pumping station, a mixing and sedimentation basin, three rapid-sand filters, a filtered-water storage basin, high-lift pumps, three steel pneumatic storage tanks riding on the distribution system, and an elevated washwater tank.

Alum is used as a coagulant. It is fed to the suction side of the low-lift pumps. Provision also is made for feeding soda ash at such times as may be required. In addition, after sedimentation and filtration of the water, a solution of sodium hypochlorite is applied as a disinfecting agent and sodium hexametaphosphate is added for corrosion control.

River water enters the treatment

plant through a timber intake structure leading to a sump under the low-lift pumping station. The water is lifted to the mixing chamber by either of two electrically-driven 1,000-gpm. deep-well pumps. These units were chosen because they were available and because they do not rquire priming equipment.

Pump sump is unusual

The 10x10-ft. sump of the pump-house is considered of unusual construction in that it is of second-hand steel sheetpiling driven to a depth of 24 ft. below the ground surface with a concrete plug tremied in place at the bottom (Fig. 2). The sheetpiling is held in place at the top by a concrete collar, which serves as footing for most of the building. The pumps and motors rest on a timber platform at ground level.

Superstructure of the pump house is the theatre-of-operation type of construction. Since the building is not heated, the two dry chemical feeders are housed in an insulated wood enclosure, roughly 2 ft. 6 in. by 6 ft. in plan and 6 ft. 6 in. high. The enclosure is heated by two batteries of six 100-w. electric light bulbs. Space for bag storage of chemicals is provided on a timber platform inside the building at the same elevation as the exterior unloading platform.

To eliminate the need for check valves, the 10-in. cast-iron discharge pipe leading from the low-lift pumps was carried over the top of the mixing chamber wall. This chamber occupies a 4-ft. width along one side of the 58x36-ft. sedimentation basin, which has an average water depth of 10 ft.

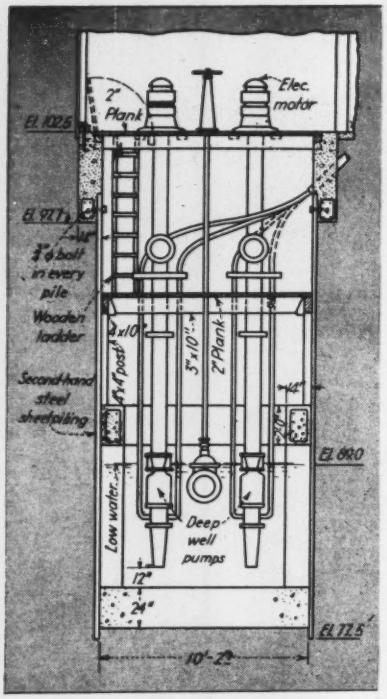


Fig. 2. Sump under low-lift pumps was constructed of second-hand steel sheetpiling. The reinforced-concrete collar at top of piling was used as foundation for much of superstructure.

A 15-min. displacement period is provided by the mixing chamber, which consists of a series of over and under wood baffles (Fig. 3). These baffles are somewhat unusual in that the spacing is varied to cause a gradual reduction in velocity from 0.9 ft. per sec. at the inlet end to 0.3 ft. per sec. at the outlet end. The mixing chamber was designed for a reduced velocity at the effluent end as a means of promoting better floc formation. Another interesting feature is that the "over" baffles may be lifted vertically when the basin is being filled or emptied (Fig. 4). This arrangement permits the use of thinner baffles, since they do not have to withstand unbalanced hydrostatic pressure.

The sedimentation basin, which is provided with a wood-plank cover to reduce possible trouble from ice, provides a 2.2-hr. displacement period and it is equipped with a longitudinal timber baffle to produce "around-the-end-flow." A wooden stilling baffle near the inlet end of the basin contains 3-in. dia. holes at 10-in. centers horizontally and 12-in. centers vertically. A similar baffle at the beginning of the return pass contains 3-in. dia. holes at 12-in. centers horizontally and 16-in. centers vertically. These baffles were installed to distribute evenly the flow throughout the cross section of the basin. The basin floor slopes to drains extending to the river to provide for disposal of the settled sludge. Settled water leaves the basin over a submerged concrete weir.

Each of the three filters is about 13 ft. square, providing a capacity of 0.5 mgd. at a filter rate of 2.0 gpm. per sq. ft. The filter media consists of 27 in. of sand and 18 in. of graded gravel. It is underlaid with 3-in. cast-iron underdrains with laterals spaced at 6-in. centers, having $\frac{5}{16}$-in. holes at 6-in. centers on each side. The holes are staggered and are located below the horizontal center line. The filters are designed for a high-rate backwash.

Washwater troughs of timber

Two washwater troughs spaced 6 ft. 8 in. on centers are provided in

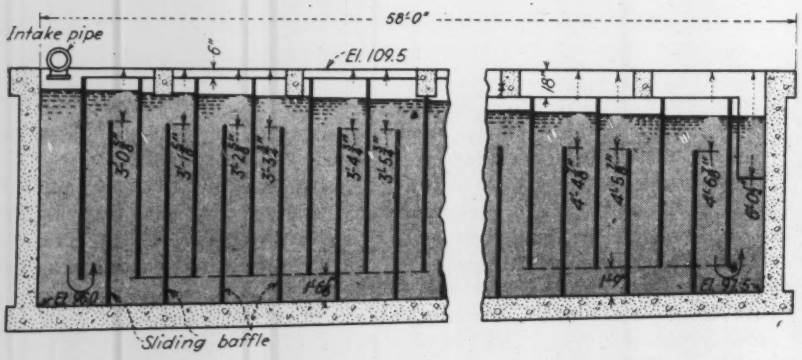


Fig. 3. Baffles in mixing chamber, which occupies a 4-ft. width along one side of the 58x36-ft. sedimentation basin, were spaced unequally to cause gradual reduction in velocity of flow through the chamber. Spacing at left end is 19¼ in. and 22 in. at right end.

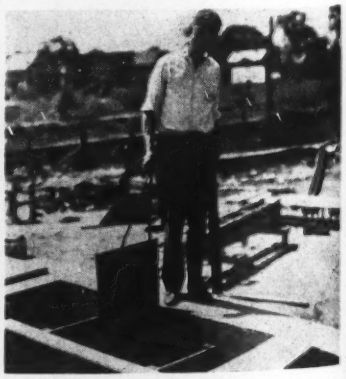


Fig. 4. Wooden "over" baffles of the mixing chamber may be raised vertically when the basin is filled or emptied.

each filter. These troughs are of wood construction (Fig. 5). They are equipped at the back end of the filter with adjustable hangers similar to those commonly used for steel troughs. Each side of each trough is made of one 2x10-in. and one 2x12-in. plank fitted together with oak dowels. White lead was applied to the joints. The bottom of the trough is made of 1-in. matched board rabbetted into the sides.

Elevation of the water surface on the filter is maintained within a 4-in. range by means of an electric, water contact switch (Fig. 6), which controls the operation of the low-lift pump. All filter valves are manually operated by floor stands on the operating floor. Reconditioned second-hand rate controllers were installed, as these were most readily obtainable.

The filtered water is stored in a concrete basin of 95,000-gal. capacity under the high-lift pump room. As the water enters the basin it is treated with sodium hypochlorite and sodium hexametaphosphate, the latter being used to protect the steel piping distribution system in the ordnance plant against corrosion.

Available pumps used

Each of the three high-lift pumps has a capacity of 500 gpm. and is of the deep-well turbine type, these units being used because they were obtainable in the required procurement time. Discharge is to the distribution system at a pressure of 50 to 75 psi. Three steel tanks "ride" on the system under pneumatic pressure. These units consist of one 3,000-gal. second-hand tank, which was already available at the plant, and two 5,000-gal. tanks, one of which had been fabricated but had never been used. Two of the high-lift pumps are automatically controlled by the tank pressure, and the third unit is manually controlled. The filters, the pumps and the pressure tanks are housed in a theatre-of-operations type of building, under which most of the filtered water basin is located. The pipe gallery is between the filtered water basin and the filters.

Washwater is stored in a 25,000-gal. wood-stave tank supported on a 12-column timber tower 30 ft. high. This arrangement places the bottom of the tank 32.5 ft. above the lip of the washwater troughs.

Since the foundation material encountered at the bottom of the various

Fig. 5. Washwater troughs of the rapid-sandfilters are of wood construction. They are equipped at end not shown (far end) with adjustable hangers similar to those used for steel troughs.

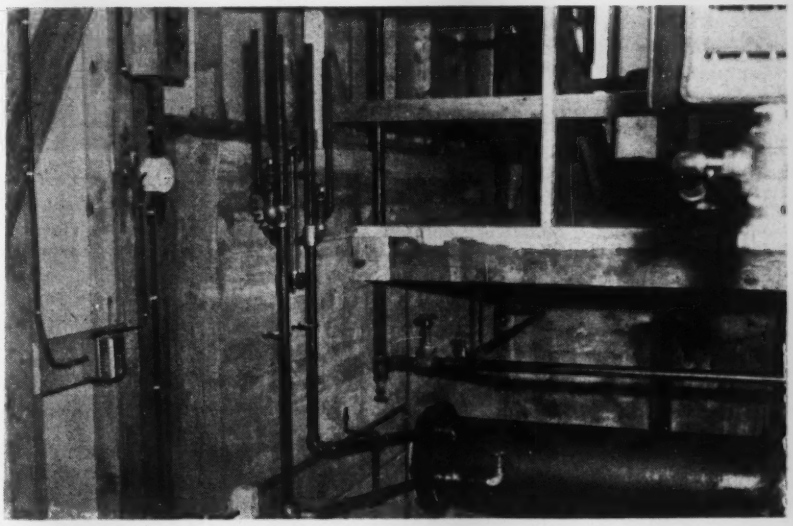


Fig. 6. Attached to the settled water pipe leading from the sedimentation basin to the filters is an electric, water-contact switch controlling the operation of the low-lift pump.

structures was filled material of low-bearing capacity, all the structures, except the low-lift pumping station, are supported on timber piles each designed for a load of 10 tons.

Construction starts in a hurry

Construction of the plant started within one month after the consultants were notified to proceed with the work, the detailed plans being made available to the contractor as prepared. Construction required three months and the plant was placed in operation immediately. No complications resulted from the rush schedule followed, the contractor always having the necessary detailed drawings by the time needed.

Operation of the plant during the few months it has been in operation has been highly satisfactory. The quality of the filtered water exceeds expectations.

The plant was built by the Boston, Mass., District Office, U. S. Engineers, Lt. Col. C. B. Rindlaub, district engineer, and Capt. John E. Eklund, area engineer. Morton C. Tuttle Co. and Lockwood - Greene Engineers, Inc., as a combination, were architect-engineer-manager and the general contractors. J. J. Keane, as project manager, was in general charge for the two firms. Metcalf & Eddy, Boston, Mass., with the writer in charge of design, were consultants on the work.

Stresses in Anchors for Wall Brackets

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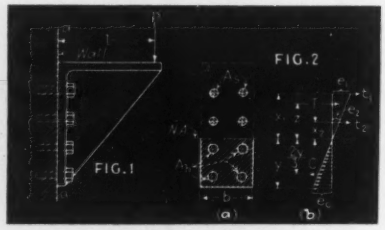
New York, N. Y.

***Contents in Brief**—An accurate method of calculating tensile stress in anchors of wall brackets under eccentric loads is outlined. Compressive force under the bracket is also calculated by simple, yet accurate, formulas. A typical example of stress calculation is included as reference for the structural designer.*

ONE PROBLEM frequently encountered by structural designers is the determination of stresses in the anchors of an eccentrically-loaded bracket in which there is a bending moment. Many examples of this condition are found which on first notice may seem totally unrelated, but upon further study prove to be identical in principle and contain analogous systems of forces. Typical examples are: Brackets that support piping, eccentric column loads, anchorages for bridge-tower columns, base connections for tall stacks subjected to wind loads, and wall brackets supporting suspended signs. Numerous other applications occur in mechanical and structural designs which occasionally puzzle designers unfamiliar with such cases.

When confronted with problems of bracket design, wherein an accurate stress-analysis of bracket anchorages is desired, the designer will be surprised by the paucity of information on this subject to be found in present day publications. In most cases authorities on bracket-design either have treated the condition with too much brevity or have suggested various ways of obviating the eccentricity by other methods of framing or supporting. Several texts recommend adoption of the rule of arbitrarily placing the neutral axis at 1/7 the distance of the bracket depth measured from the compression end of the bracket in cases where the wall and bracket are of the same material. A few more elementary treaties completely disregard the existence of a neutral axis and consider rotation to occur at the extreme compression end of the bracket.

In order to present the elements of the problem in their simplest terms, yet sufficient in scope to cover the majority of cases encountered, we will consider only the case in which a bracket is bolted directly to a wall composed of material which may be either the same as that of the bra or of dissimilar physical charac istics. This case is shown in Figs and 2. It has its exact counterpart many of the typical examples rec in the opening paragraph of t article.



Typical conditions in an eccentrically loaded wall bracket are shown in Fig. 1. Cross-hatched areas in Fig. 2a indicate the tensile and compressive forces resisting bending moment, while a resolution of these forces is shown in Fig. 2b.

Legend of terms

A_s = Total net area of bolts in one horizontal row.
n = Number of horizontal rows of bolts.
A_h = Area of bolt holes in bracket within compression area.
b = Breadth of bracket.
E_s = Modulus of elasticity of bolt metal.
E_c = Modulus of elasticity of wall material
e_1 and e_2 = Elongations of bolts at the respective x_1 and x_2 distances from the neutral axis
e_c = Maximum compression in wall.
z = Distance from neutral axis to the center of tension.
y = Total depth of wall area in compression.
C and T = Total compressive and tensile forces, respectively.
t_1 and t_2 = Total forces in all bolts at x_1 and x_2 distances, respectively
P = Eccentric load on bracket.
M_b = External bending moment.
M_c = Resisting moment of wall in compression.
M_t = Resisting moment of bolts in tension.
S_c = Maximum unit compressive stress in wall.
S_t = Maximum unit tensile stress in bolts.
S_s = Unit shearing stress.
S_r = Resultant unit stress.

The action of a load p at l dista on the bracket in Fig. 1 causes development of forces on the verti plane a-a, as shown in Fig. 2a. T is actually the equivalent of a tra verse section through a loaded be with the working areas shown cr hatched. In evolving the force di gram in Fig. 2b, infinite rigidity assumed for the bracket and all formations are considered propo tional to their respective distan from the neutral axis. We must al acknowledge the law of proporti ality regarding stress and str within the elastic limit of the m terials. The position of the neut axis is automatically located acco ing to the ratio of yield between members resisting tension to that sisting compression and must found by trial.

With these principles laid down following necessary equations for stresses in the assumed beam secti may be established just as in a simple beam:

$M_b = Pl \qquad T = C \qquad M_b = M_c = M_t$

and assuming temporarily that neutral axis is fixed between the middle rows of bolts we have:

$$T = \Sigma t = t_1 + t_2$$

$$t_1 = e_1 E_s A_s = \frac{x_1}{y} e_c E_c A_s$$

$$t_2 = e_2 E_s A_s = \frac{x_2}{y} e_c E_c A_s$$

or

$$T = e_c E_s A_s \left(\frac{x_1}{y} + \frac{x_2}{y} \right)$$

$$C = \frac{e_c}{2} E_c (yb - A_h)$$

and

$$z = \frac{x_1 t_1 + x_2 t_2}{t_1 + t_2} = \frac{x_1^2 + x_2^2}{x_1 + x_2}$$

$$M_t = M_t = \left(z + \frac{2}{3} y \right) (T \text{ or } C)$$

$$M_c = \left(\frac{x_1^2 + x_2^2}{x_1 + x_2} + \frac{2}{3} y \right) .5 E_c e_c (yb - A$$

$_c$ from M_c

$$= \frac{2\,Mc}{E_c\,(yb - A_h)\left(\frac{x_1^2 + x_2^2}{x_1 + x_2} + \frac{2}{3}y\right)} \quad (1)$$

$$= \left(\frac{x_1^2 + x_2^2}{x_1 + x_2} + \frac{2}{3}y\right) A_s E_s e_c \left(\frac{x_1}{y} + \frac{x_2}{y}\right)$$

$_t$ from M_t

$$\frac{M_t}{A_s E_s \left(\frac{x_1}{y} + \frac{x_2}{y}\right)\left(\frac{x_1^2 + x_2^2}{x_1 + x_2} + \frac{2}{3}y\right)} \quad (2)$$

$= e_c E_c \qquad S_t = \frac{x_1}{y} e_c E_s \qquad S_s = \frac{P}{n A_s}$

$$d\ S_r = \frac{S_t}{2} + \sqrt{\left(\frac{S_t}{2}\right)^2 + S_s^2}$$

Illustrative example

In order to explain the application d proper sequence of using the ove formulas it is best to solve a rticular case. Assume a cast iron acket bolted with steel bolts to a ncrete wall as shown in Fig. 1. t $P = 12{,}500$ lb., $l = 13$ in., with in. dia. bolts arranged in two verti- l rows of four each with horizontal d vertical spacings equal to 4-in. ee Fig. 2a). Assume the edge dis- nce of the bolts at the botom of the acket is 1¼ in., and the total effec- e depth of the bracket = 13.25 in.; = 7 in.; $A_s = 2\text{x}\ .551 = 1.102$ sq. in.; $E_s = 30{,}000{,}000$ psi.; $E_c = 2{,}000{,}000$ psi.

Since we have arbitrarily assumed in our derivations that the neutral axis fell within the middle group of bolts we will now accept this position for our first trial figure of A_h:

$A_h = 4 \times 1.125_2 \times .7854 = 3.96$ sq. in.

and $yb - A_h = 7\,y - 3.96$, also $x_1 = 13.25 - y$

$x_2 = x_1 - 4 = 13.25 - (y + 4)$

solving for Z in terms of y gives:

$$z = \frac{(13.25 - y)^2 - [13.25 - (y + 4)]^2}{13.25 - y + 13.25 - (y + 4)}$$

or $$z = \frac{130.25 - 22.5\,y + y^2}{11.25 - y}$$

By equating the formulas (1) and (2) and eliminating the term

$$\frac{x_1^2 + x_2^2}{x_1 + x_2} + \frac{2}{3}y$$

in the denominator of each equation we arrive at:

$$\frac{1}{7 - 3.96} = \frac{1}{1.102 \times 30 + \left(\frac{22.5 - 2y}{y}\right)}$$

which resolves into the quadratic equation:

$$7\,y_2 - 3.96y = 745 - 66.2y$$

or $$y_2 + 8.9y = 106.4$$

By completing the square, two values for y are yielded:

$y = -15.73$ in. and $+6.83$ in. — obviously 6.83 in. is the real root. Checking A_h with the newly found value of y, the first assumption for the neutral axis location is found to be correct since y includes four bolt holes in the compression area.

$$z = \frac{130.25 - 153.8 - 46.7}{11.25 - 6.83} = \frac{23.15}{4.42} = 5.23 \text{ in}$$

e_c may now be found from either formulas (1) or (2)

$$e_c = \frac{2M_c}{E_c\,(7y - A_h)\,(Z + 2/3\,y)}$$

$$e_c = \frac{2 \times 12{,}500 \times 13}{2 \times 10^6 \times (47.8 - 3.96)(5.23 + 4.55)} = \frac{13}{80 \times 43.84 \times 9.78}$$

$e_c = .000377$ in. $e_t = \frac{x_1}{y} e_c = \frac{6.42}{6.83} \times .000377$

$= .000354$ in.

$S_s = .000377 \times 2 \times 10^6 = 754$ psi. in the concrete.

$S_t = .000354 \times 30 \times 10^6 = 10{,}600$ psi. in each extreme top bolt.

$$S_s = \frac{12{,}500}{4 \times 1.102} = 2{,}830 \text{ psi.}$$

$$S_r = \frac{10{,}600}{2} + \sqrt{\left(\frac{10600}{2}\right)^2 + 2830^2}$$

$$S_r = 5300 + \sqrt{28.2 \times 10^6 + 8 \times 10^6} = 11{,}300 \text{ psi.}$$

Pennsylvania Court Holds Contractor To Literal Reading of Agreement

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A CASE RECENTLY DECIDED in Pennsylvania should be of interest to engineers and contractors. The case is that of Joseph Sgarlat vs. Moses Griffith, 152 Pennsylvania Superior Court 233 (1943). A brief summary of it follows.

In that case, the plaintiff, who was an excavation subcontractor, agreed with the defendant, a general contractor, to do all the excavating and concrete work for the sum of $3,050. The contract further provided that in excavating if rock be found which would require removal by blasting, $1.10 per cu.yd. will be paid for by measurements of the architect and certificate furnished by him." The claim was for a sum of $902 for excavating about 820 cu.yd. of rock.

The rock was not removed by blasting but with a jackhammer. The jackhammer process was more expensive than blasting. It was employed because blasting might have resulted in damage to adjacent buildings and nearby persons. The court said that the question was whether, whatever his motive, having removed the rock without blasting, the plaintiff can recover the extra compensation demanded.

The plaintiff contended that the phrase "rock which would require removal by blasting" described the kind of rock and not the method of removal, that if rock was found which ordinarily would require blasting, the plaintiff could use any method for removing it and still secure extra compensation.

The court held that in the interpretation of contracts, "the ordinary meaning of language throughout the country is given to words unless circumstances show that a different meaning is applicable".

The court also said that "tested by these standards, it is clear that the parties contracted in reference to blasting. They were describing a method and they described it by using a common term known to all men. The popular, ordinary and normal meaning of blasting is a mode of rending or disintegrating rock or other substances by means of dynamite or other explosive. Any other meaning attributed to the phrase would be forced, strained and unnatural. Since blasting in that sense was contracted for and not performed the appellant cannot recover."

This decision only serves to reemphasize the need for unusual care in writing contracts that may come before our courts or quasi-judicial bodies for interpretation.

Erosion Causes Invert Break In Boulder Dam Spillway Tunnel

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Designing Engineer on Dams, Bureau of Reclamation
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***Contents in Brief**—On Dec. 12, 1941, after four months operation of the Arizona spillway tunnel at Boulder Dam inspection disclosed an invert break. The main break was about 112 ft. long and 33 ft. wide with a maximum scour depth of 36 ft. Areas outside the main break showed minor pitting and scouring. Surveys showed misalignment in the original alignment. Repair was accomplished by bulkheading off the backflow of the river at the tunnel outlet, unwatering, trimming and cleaning the scoured area, backfilling with concrete, and carefully finishing the surfaces. Holes were concreted by the prepacked-gravel grout-intrusion method.*

DESTRUCTIVE EROSION of a part of the invert of the inclined spillway tunnel on the Arizona side of Boulder Dam has presented a complex problem of lining restoration. The erosion is of definite interest to hydraulic engineers. To make the occurrence clear all facts are covered as fully as limited space will permit in the following text and illustrations.

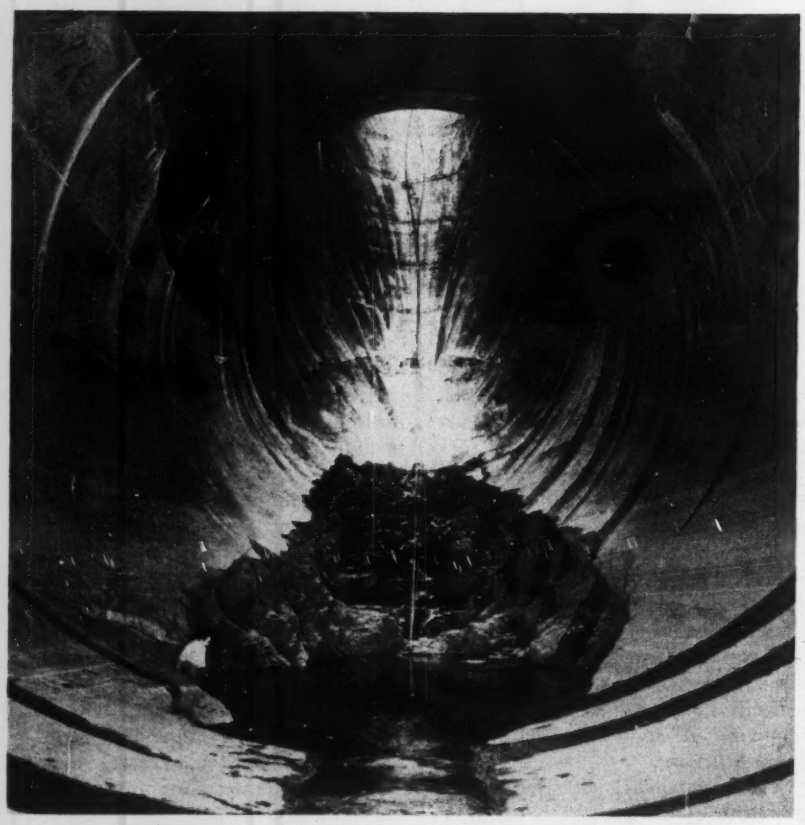

Fig. 1. Appearing small in the great 50-ft. bore the invert break in the Arizona spillway tunnel at Boulder Dam was 112 ft. long and 33 ft. wide.

Spillway provisions at Boulder Dam include tunnels slanting down through the abutting rock cliff at each end of the dam—one tunnel on the Nevada side and one on the Arizona side of the river. These tunnels are counterparts and the Arizona tunnel alone, in which the invert break occurred, is described. Each spillway consists of a concrete ogee-crest structure, the flow over which into a deep concrete-lined side channel is controlled by four 100 x 16-ft. automatically-operated steel drum gates. Outlet from that channel is through a sharply descending tunnel which connects by a vertical curve with the downstream tangent of one of the four 50-ft. diversion tunnels that were used in unwatering the site during the construction of the dam. As shown by the drawing, Fig. 2, a concrete plug was placed in the diversion tunnel behind the zone of junction with the spillway tunnel. The pipe through the plug was installed to handle leakage during plug construction and was finally partly dismantled and the space occupied was filled with concrete and grout. It will be noted that the front face of the plug forms a vital part of the spillway tunnel invert at the point of failure. The plug at the Nevada spillway was the same except that the leakage-relief pipe was not needed. All remaining details of the spillway structure that it is needful to note are given in Fig. 2.

The spillways were designed for a capacity of 200,000 cfs. each with the drum gates completely lowered and the water surface at the top of the dam, which is El. 1232. The inclined drop of over 500 ft. results in a computed velocity of about 175 ft. per sec. immediately downstream from the vertical bend in the tunnel.

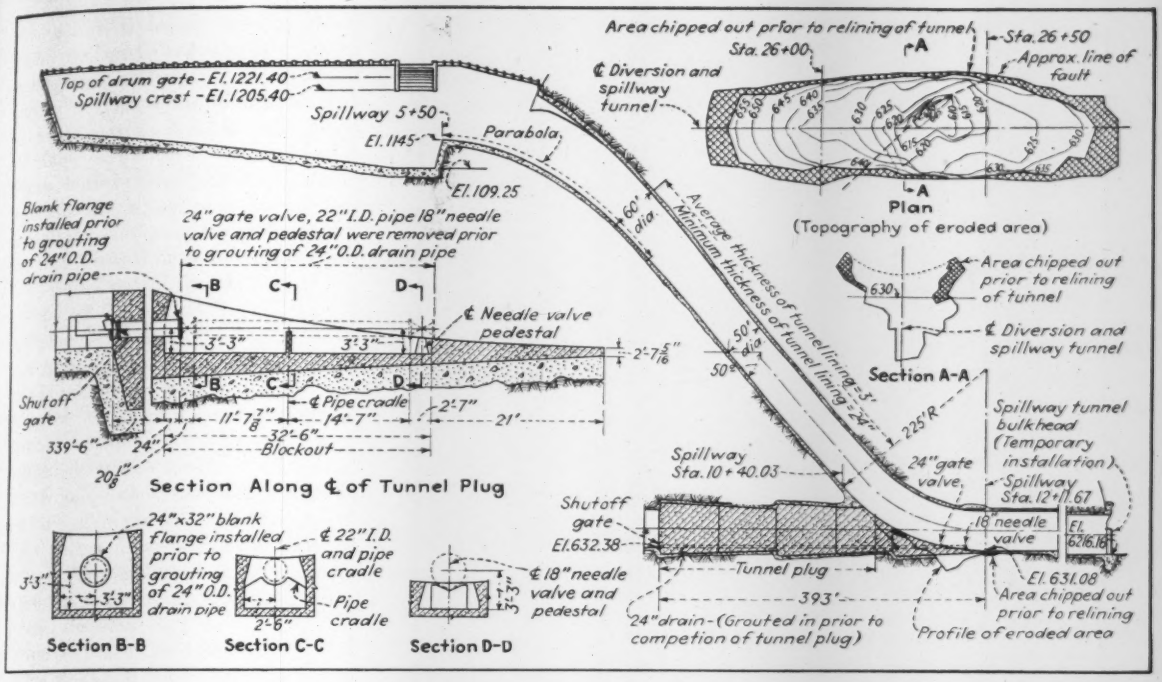
Area chipped out prior to relining of tunnel
Sta. 26+00
Sta. 26+50
Approx. line of fault
℄ Diversion and spillway tunnel
Top of drum gate - El. 1221.40
Spillway crest - El. 1205.40
Spillway 5+50
El. 1145
Parabola
El. 109.25
60' dia.
Average thickness of tunnel lining = 3'
Minimum thickness of tunnel lining = 2'
Plan
(Topography of eroded area)
Section A-A
Blank flange installed prior to grouting of 24" O.D. drain pipe
24" gate valve, 22" I.D. pipe 18" needle valve and pedestal were removed prior to grouting of 24" O.D. drain pipe
℄ Needle valve pedestal
℄ Pipe cradle
Shutoff gate
339'-6"
Blockout
Section Along ℄ of Tunnel Plug
225' R
Spillway tunnel bulkhead (Temporary installation)
24" gate valve
Spillway Sta. 10+40.03
Spillway Sta. 12+11.67
18" needle valve
El. 621.16
Shutoff gate El. 632.38
Tunnel plug
El. 631.08
393'
24" drain - (Grouted in prior to competion of tunnel plug)
Profile of eroded area
24" x 32" blank flange installed prior to grouting of 24" O.D. drain pipe
℄ 22" I.D. and pipe cradle
Pipe cradle
℄ 18" needle valve and pedestal
Section B-B
Section C-C
Section D-D

Fig. 2. Profile of Arizona spillway tunnel at Boulder Dam showing the structure at the zone of the break in the invert.

without consideration of any reduction by reason of air entrainment. Numerous hydraulic model tests were made in conjunction with designing the spillways. (See Bulletin 1, Part VI—Hydraulic Investigations—Final Reports—Boulder Canyon Project.) Although the majority of the hydraulic tests were made to determine the shape of the side channel and transition to the inclined tunnel, part of the tests influenced the final design of the vertical bend. Other model tests indicated that the concrete tunnel lining would be adequately resistant to wear from the unusual velocity to which it would be subjected.

Altogether, the tests inspired confidence of the Bureau of Reclamation staff engineers and consultants that the concrete tunnel lining would be able to withstand the effects of the high velocities, particularly as the contract specifications provided that special care be taken in the formwork and finishing and every precaution be taken to secure concrete of the highest possible quality in the tunnels to be subjected to high velocities.

Although Boulder Dam was completed in 1936, the water did not rise in the reservoir to an overflow level until the spring of 1941. On May 27 of that year the spillway drum gates were floated for the first time, and on July 31 the reservoir water surface was within 1 ft. of the top of the completely-raised gates. On Aug. 6 the Arizona gates were lowered sufficiently to permit an overflow of 8,000 cfs., after which, except for several hours on Aug. 14 given to inspection, that spillway was operated continuously until the reservoir water surface dropped below the fixed crest on Dec. 1, about four months. The hasty inspection of the tunnel lining made after eight days of continuous operation disclosed no indications of erosion. The Nevada gates were lowered slightly a few hours on Aug. 16 for operation testing, and were operated again about 20 days in November. The maximum flow through the Arizona spillway tunnel was 38,000 cfs. and through the Nevada tunnel 14,380 cfs. Operation data of interest are given in the accompanying table.

On Dec. 12 inspection by boat of the Arizona spillway disclosed serious damage from erosion. Fig. 1, looking upstream, shows the eroded area prior to pumping out the deep cavity. The deeply eroded area, Fig. 2, was confined almost entirely to the downstream block of the tunnel plug. The erosion had taken out much of the concrete in the block, had gone through the bottom of the plug and the former diversion tunnel lining and had formed an irregular hole some 24 ft. deep below the bottom of that lining. The steel drain pipe had been broken off 10 ft. back of the end of the hole, Fig. 1, and the grout filling had been removed from 65 ft. of the inside of the pipe that was still in place. A narrow cavity extended upstream and to the left about 20 ft. from the general contours of the eroded hole, along the line of a fault shown on Fig. 2. The principal infiltration of water was a small stream of only a few miner's inches. Small cavities and heavy undercutting were noted in the region of contact between the lining and foundation rock. Exposed rock surfaces indicated that the concrete and the rock below the concrete had been removed in large angular pieces.

Regardless of the cause of the initial erosion, it appears evident that, once started, the existence of "cold joints" in the mass concrete of the tunnel plug and the existence of a fault zone in the rock, below the diversion tunnel lining, were largely responsible for the deep hole.

The concrete lining downstream from the eroded area showed pronounced striation marks, and much of the invert was worn down to a

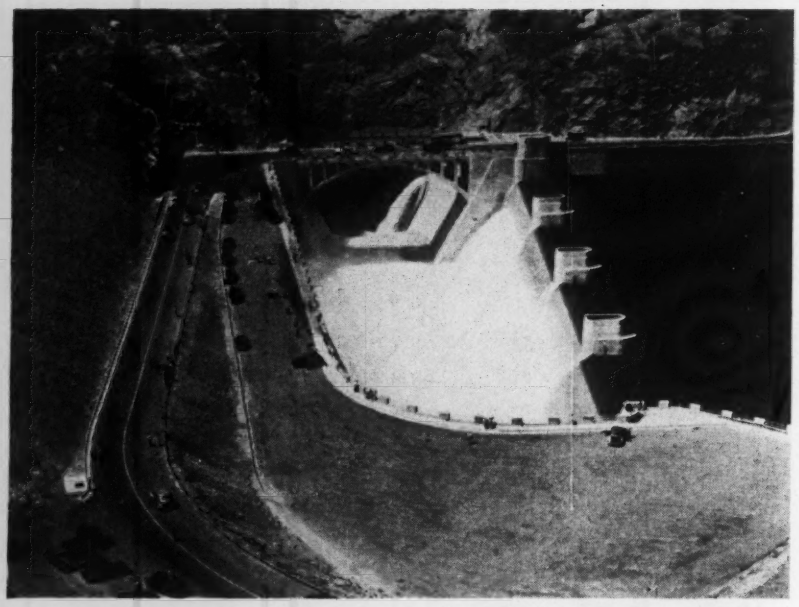

Fig. 3. Spillway on the Arizona side at Boulder Dam. It discharges into the inclined tunnel at the bottom of which erosion developed during the fall of 1941.

rough-textured terrazzo-like finish. There was no evidence that joints or cracks were particular points of weakness, with the exception of one crack a few feet downstream from the deep hole, which had eroded to a depth of about 6 in. In the 50 ft. of invert immediately upstream from the heavily eroded area, there were several small shallow holes which gave evidence of erosion by cavitation. The invert in that reach of the inclined tunnel, was noticeably out of vertical alignment as shown by the misalignment of the rope, Fig. 4, laid along the centerline of the invert. Careful surveys showed that at the upstream edge of the eroded area the actual grade of the invert agreed with the designed grade; at the vertical tunnel-plug joint it was 0.15 ft. below grade; at 38 ft. upstream from the eroded area, it was 0.8 ft. below grade; at 54 ft. upstream from the eroded area it was 0.4 ft. below grade; and at 75 ft. upstream it was only 0.1 ft. below, or practically back to the designed grade. Thus for 75 ft. upstream from the damaged area the gradient was dished down from the true curvature of a 225-ft. radius, designated on the design drawings. The surveys also showed that the gradients 5, 10 and 15 ft. to the right and left of the invert center line were dished and lacked uniformity; there were slight dips and swells all culminating in a more pronounced bulge at the upstream end of the eroded area.

The concrete surfaces in the upstream portion of the eroded hole, and immediately downstream from the invert bulge, were rather uniformly and heavily pitted as indicated by Fig. 1 and 4.

Conjectural causes

Apparently no one can state positively that this or that condition was definitely accountable for the conditions found. Based upon the evidence, different theories have been conjectured by various engineers within the bureau's organization, some of which are as follows:

1. Aggravated pitting of the concrete surface as a result of cavitation induced by misalignment of the tunnel immediately upstream from the erosion. The surface once disrupted by pitting would then be subject to the impact of the high-velocity water, with resultant further damage.

2. As is the usual practice on slopes less than 2:1, the concrete lining of the invert of the horizontal tunnel and of the inclined tunnel for some distance upstream from the erosion was placed and finished without forms. Because of the tendency of concrete placed on slopes to slump to lower levels, it is customary to minimize vibrating and other compaction operations. The resulting concrete is considerably less dense than concrete placed in forms. Except for the trowelled-surface finish, this lack of compaction was noticeable along the sides of the eroded hole. The impact of the water in rounding the vertical curve would be greater than the force exerted on the horizontal leg of the tunnel, and thus the tendency toward erosion in the former region of unformed concrete would exceed that in the latter.

3. Initial breakage of the downstream thin section of the tunnel plug, which was subject to vibration and had little bond with the earlier-placed diversion tunnel lining.

4. Disruption of the concrete placed in the block-out at the downstream end of the tunnel-plug drain, aggravated first by shrinkage of the concrete mass and later during spillway discharge by vibration.

5. Movement in the fault underlying the toe of the inclined tunnel. However, there was no indication of recent movement in the fault or in the lining on either side of the eroded hole.

6. Uplift pressure under the lining. After the hole was unwatered, a total quantity of 70 gal. per min. of water, under pressures of 130 to 200 lb. per sq. in., was found to be flowing from seams in the rock.

The broken condition of the foundation rock has not been given as a possible cause, although undoubtedly it greatly influenced the depth of the erosion.

Repairs a detail task

With conditions fully appraised, plans for repairs were begun in April, 1942. It was decided that replacement of the lining should be made against forms to ensure maximum density. Although the bureau had not placed any concrete by the prepacked and grout-intrusion process, as developed by the Dur-ite Company of Chicago, investigations indicated that such a method had definite advantages in that the high bonding strength of prepacked concrete, its low cement content and low temperature rise, small shrinkage and therefore less inclination to cracking, would more than compensate for its slowness in attaining strength. However, the primary reason for adoption of that process was the conclusion that the repairs could be made more economically than by regular concrete placing methods.

The concrete and rock around the entire eroded area were excavated to a minimum depth of 5 ft. Fig. 2 shows the outside lines of the excavation, about 375 cu.yd. of concrete and rock were removed. The general procedure was to line drill around the damaged area with holes spaced on 3-in. centers, after which the material was excavated by paving breakers to within 1 ft. of the drilled holes. A final surface edge was cut with a carborundum-disk saw to a depth of 1 in. immediately outside of the line of drill holes. The concrete inside of the sawed line was then removed with chipping hammers to a depth of 1 ft., following which the excavation to final depth was by the plug-and-feather method and by paving breakers.

The 24-in. steel drain pipe remaining in the tunnel plug was removed to 60 ft. back by cutting it in small pieces with an acetylene torch. The drain was then filled with ¼- to ½-in. washed gravel, blown into place through a 1½-in. pipe by a gunite machine. The void space in the placed gravel was about 33 percent, which was filled with grout at a final pumping pressure of 150 lb. per sq. in.

The total inflow into the eroded hole was only 70 gal. per min. of which about 60 gal. came from the fault seam. This was collected in a gravel drain, connected by a vertical riser pipe to the proposed surface of the first lift of concrete. After that lower lift of concrete was placed and had set sufficiently, the gravel drain was grouted through the vertical pipe under a maximum pumping pressure of 200 lb. per sq. in. Other springs and seepages were intercepted by holes drilled into the concrete and rock, through which thin grout was injected under pressures varying from 50 to 500 lb. per sq. in. Prior to placing the upper lift of concrete, the total foundation inflow had been reduced to less than 1 gal. per min., which was completely sealed off after all concrete had been placed.

Prior to placing gravel, all broken or unsound rock and concrete and unusually smooth surfaces of both concrete and rock were chipped and then thoroughly cleaned by sand blasting and washing with high-velocity jets of air and water.

After three cavities under the old concrete lining had been filled with ¼- to ½-in. gravel and the voids grouted under a pressure of 50 lb.

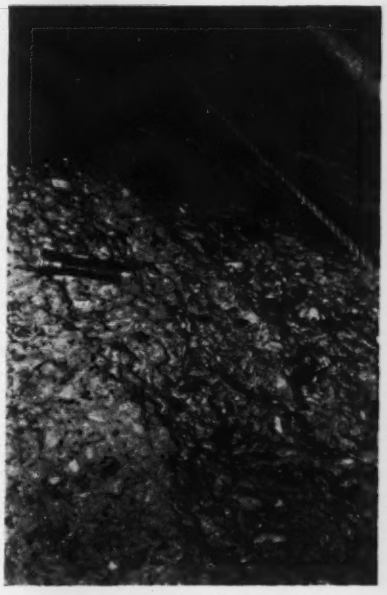

Fig. 4. Close-up view shows appearance of concrete at upstream end of the eroded area. This is typical of erosion resulting from cavitation. The slight bend in the rope (top center) indicates the misalignment of lining profile.

per sq. in., against bulkhead forms, attention was given to placing the regular lower lift of concrete. That lift included the deep fault zone and the remainder of the eroded hole below elevation 626. Washed gravel, 38 percent ¾- to 1½-in. size, and 62 percent 1½- to 3-in. size was placed and tamped in about 12-in. layers with heavy paving breakers equipped with tamping heads. The void space was estimated at about 35 percent after compaction. A total of 340 cu.yd. of gravel, measured loose before placing, was used in the lower lift. During the placing of gravel, 1½-in. vertical-pipe risers were installed at about 5-ft. centers over the entire area, through which the grout was pumped at necessarily low pressure as the top of the lift was not held by forms. Grout was brought up through the voids as level as possible. When the grout approached the surface of the lift, uplift and floating of the gravel were evident: this condition was remedied by vibrating the top gravel and then recompacting it with paving breakers acting on planks 3 ft. long. In the meanwhile grout was injected where necessary below the surface through a short jet pipe.

Forms for placing the upper lift of concrete were designed to resist a grouting pressure of 10 lb. per sq.in. with only slight deflection. Accurate alignment in setting the forms and smooth tight surfaces of the 1 x 8-in. lagging were considered important. Any cracks were filled with plastic wood and the offsets removed by air-operated grinders with sandpaper disks. Removable doors, 1-ft. square, at about 8-ft. centers were built into the forms for the introduction of gravel. Numerous ¾-in. holes were drilled through the lagging to serve as vents during the grouting of the gravel; after serving that purpose the holes were plugged with corks. The forms were held in place by 1¼-in. steel anchor bars spaced at about 3-ft. centers and grouted into holes drilled 10 ft. into the underlying rock and 6 ft. into the old concrete and the previously placed lower lift of prepacked concrete. Prior to grouting the gravel, the anchor bars were prestressed by uniform tightening of nuts over the entire area. For the injection of grout about 250 1½-in. steel pipes were installed radially to the invert. They were seated loosely in holes drilled 3 in. deep in the foundation and extended upward through the form lagging terminating in bolt connections. In general, the spacing was 4½ ft. parallel to the tunnel and 6 ft. transversely.

Before placing the upper or final lift of concrete, the surface of the lower lift was chipped several inches in depth to remove all laitance and other objectionable material and to

FLOW THROUGH THE SPILLWAY TUNNELS AT BOULDER DAM

MONTH, 1941	DAYS	VOLUME IN ACRE-FEET	AVERAGE FLOW IN SECOND-FEET
Arizona Spillway			
August	25	750,383	15,133
September	30	813,645	13,674
October	31	811,944	13,205
November	30	614,550	10,328
December	0.5	1,000	1,008
	116.5	2,991,522	12,946
Nevada Spillway			
November	19.5	156,163	8,008

Fig. 5. Completion of repairs restores the tunnel lining to almost polished perfection with the misalignment corrected.

expose the larger size aggregate. After roughening smooth surfaces and cleaning all surfaces by sand blasting and air and water jets, the hole was ready for placing gravel. Except for a depth of 3 ft. radially below the forms, the mixture of washed gravel was the same as had been placed in the lower lift of concrete, and it was spread and compacted in practically the same manner. Gravel in the top 3 ft. consisted of 45 percent $\frac{3}{8}$- to $\frac{3}{4}$-in. size and 55 percent $\frac{3}{4}$- to $1\frac{1}{2}$-in. size. The mixture was spread in 6-in layers and compacted with chipping hammers with small tamping heads. When the gravel filling approached the forms, the remainder was blown into place through a $1\frac{1}{4}$in. nozzle, and this was compacted by ramming and tamping with 2 x 4-in. timbers. A small mechanical vibrator was used to compact the material around the edge of the eroded hole. Grout was pumped into the insert pipes under a pressure of about 10 lb. per sq.in., not more than 10 cu.ft. being injected through a single pipe at one time. As the grout rose upward through the voids, the pipes were withdrawn progressively so that generally only the lower 3 ft. of each pipe was in contact with the grout during the operations. A continuous period of 80 hr. was consumed in grouting the upper lift, which was finished on Nov. 12, 1942. From the amount of grout introduced, the void space in the gravel was estimated as 36 percent. Although the form bolts were loosened slightly after the grout had set for three days, actual removal of the forms was not commenced for three weeks.

The entire volume of material placed in the deep hole, including the tunnel plug drain end the backfilling of the 375 cu.yd. removed in trimming operations, was about 1,460 cu.yd.

In addition to filling the deep eroded hole, advantage was taken of the tunnel being unwatered to make other repairs. The roughened invert for a distance of 200 ft. downstream was made more uniform and smooth by bushing and grinding. The shallow holes in the inclined tunnel upstream from the large eroded area were patched by approved dry-pack methods. The pronounced bulges, in the inclined tunnel, were removed by bushing and grinding. Fig. 5 shows the general appearance of the tunnel after the completion of repairs. The bulkhead at the downstream portal of the tunnel which held back the tailwater was removed in April, 1943. The relatively long time consumed in making the repairs was due largely to the difficulties of access, the unusual thoroughness with which the work was done and, particularly, to the scarcity of men and equipment during the war period.

For a project of such unusual dimensions as the Boulder Dam and appurtenant structures, it will be surprising if there are not other operation and maintenance repairs required in the future, which though they will appear large will be comparatively small in relation to the magnitude of the original work.

Acknowledgments

The Bureau of Reclamation is a branch of the United States Department of the Interior of which Harold L. Ickes is Secretary and H. W. Bashore, Commissioner of Reclamation, with headquarters in Washington, D. C. All engineering and construction work of the bureau is supervised by S. O. Harper, chief engineer, Denver, Colo. J. L. Savage, Denver, is chief designing engineer. Operation and maintenance of the Boulder Canyon Project is in charge of E. A. Moritz, director of power, with offices in Boulder City. Repairs to the Arizona spillway tunnel were made under the direction of D. S. Walter, field engineer.

Through 130 ft. of Plastic Clay to Rock

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Consulting Engineer, Cleveland, Ohio
(Now, Major, Corps of Engineer, U. S. Army)

***Contents in Brief**—Rigid support for a blast furnace to be built over a deep layer of plastic clay was obtained by open pipe caissons extended into solid rock by drilling and filled with concrete. Material with a clay fraction of 5 to 75 percent, half of which was collodial, with moisture up to 42 percent, had little bearing value yet was difficult to drive through. Pile driving experience shows necessity for better foundation exploration and preservation of samples in their original state. Load tests on piles indicated that total penetration per blow, instead of retained "set", should be used in bearing-value pile formulas. Cold-formed electric-weld seam pipe withstood hard driving best.*

FOUNDATIONS for a modern, 1,200-ton-per-day blast furnace, a top-heavy structure 200 ft. in the air, required unusual support through 130 ft. of plastic clay to rock. The solution was to use 25 open-pipe caissons drilled into the rock for the main structure while lighter loads were carried on more than 5,000 pipe-piles, driven generally closed-end, to rock.

The drilled-in caissons required much less steel than would have been used for pile supports of the heavy main structure. Construction time and cost, including patent royalty for the drilled-in caissons were about the same as for a steel piling foundation. Keying into the rock 140 ft. below the ground and complete visual inspection of the foundations for the caissons assured an unyielding support.

The blast furnace is located on the flood plain of a small river on a generally level site about 8 ft. above the water. Dry sample test borings over the site were made prior to preparation of the foundation plans. Nineteen borings were taken to a level about 65 ft. below ground surface and two were carried presumably to the bedrock but more probably only to a boulder and clay mantle a few feet above it.

Borings and samples indicated that a deep layer of "stiff blue clay" generally underlaid the site 30 to 40 ft. below river level, with sand or pebbly clay and sand layers extending to the bottom of the borings. The two borings to rock showed a succession of layers of "stiff blue clay" with sandy and stony inclusions. Only one thin layer of "plastic blue clay" was recorded.

A later series of borings on the site and the results of pile driving showed that the entire area was made up of irregular beds of plastic to highly plastic clays with only an occasional bed of fairly stiff clay. A thin mantle of boulder clay, ground-up shale with broken pieces of rock and small boulders sometimes referred to as hardpan, covers the unweathered bedrock, which is a late Devonian shale 120 to 140 ft. below water level.

The samples from a single dry-sample boring made after the foundation job had been started were carefully sealed and the soil analysis shown in Fig. 2 was made by the author in the laboratory of Case School, Cleveland. This analysis shows clearly that no soil layer exists

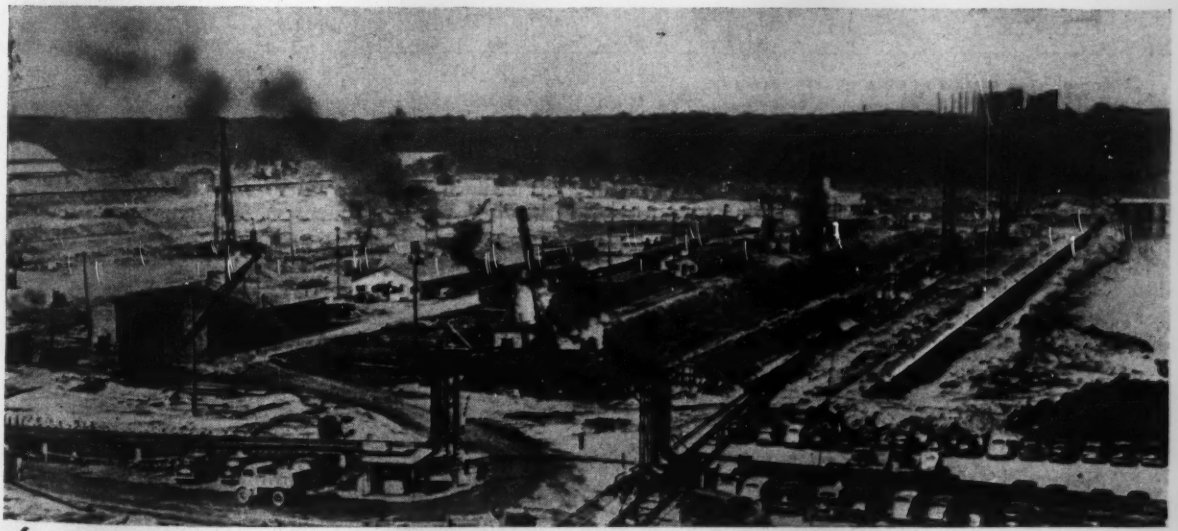


Fig. 1. Foundation piles and caissons for support of a blast furnace and ore dock over plastic clay required six drivers working for several months.

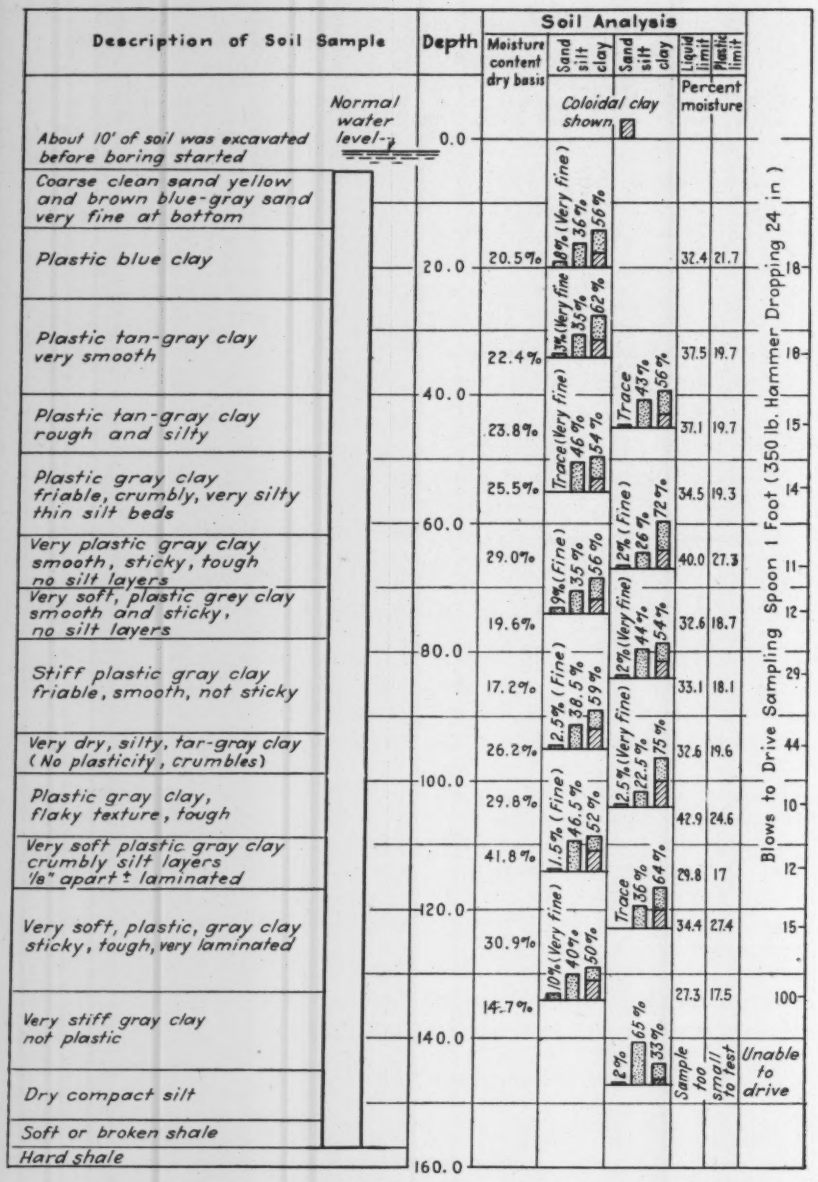


Fig. 2. Analysis of samples taken under carefully controlled conditions after the job was under way. Earlier unprotected samples indicated much better bearing value than was actually found.

short of boulder clay or bedrock that can be depended upon to support the load of dock walls, with their ore handling machinery, or blast furnaces and stoves.

Except for a silty clay bed about 80 ft. below water level, all of the clays encountered were "plastic" or even "very plastic" until the layer directly over the rock was reached. The clay fraction in the samples ranged from 54 to 75 percent of the total with colloidal material making up half of the clay fraction. One 10-ft. thick bed of clay had a moisture content of nearly 42 percent yet the liquid limit was only 30 percent. Another very plastic bed of the clay was filled with small bubbles of gas.

All of the soil borings, taken at random over the site, clearly showed that the soil characteristics vary widely from point to point. One fact only was clear—the entire site was underlain at some depth, generally between 70 and 120 ft. below the surface, with a highly plastic clay. It is probable that the present river valley has been eroded about 100 ft. deep into a broad delta plain. The delta, laid down in a post-glacial lake, was built from the sand, silt and clay ground-up by the ice of the last glacial period and washed into the lake.

All of the clay beds below water level are highly plastic and are as soft and smooth as modeling clay. A rolled ball of these clays, while highly plastic when excavated, will become crumbly in 2 or 3 hr. and very hard in 24 hr. Soil samples of such material rapidly change character when the cans are opened for inspection and give misleading information as to their load supporting value or resistance to the penetration of piles. The untimely drying out of the soil samples from the first test hole borings probably is the reason for the wide discrepancy between the test boring record and the soil as actually encountered.

Piles of iron ore, which may be 100 ft. high and produce a load of ten tons per sq.ft. will be spread over part of the site. Geologically the original level of the site was probably 100 ft. above the present ground, this weight having been removed through river erosion. It is therefore believed that the soil, despite plasticity, will support the ore load especially as the ground is more or less stabilized by lines of pipe-piles on both sides of the storage area.

Pile formulas misleading

Cylindrical and tapered steel piles, ordered from the original boring data, were driven 35 ft. into the plastic clay with a No. 1 single-acting Vulcan pile-hammer (5,000-lb. ram, 36-in. stroke, 15,000-ft. lb. blow). Piles were driven to a resistance that by any of the commonly used bearing-capacity formulas, based upon the "set" produced, would have safely supported 70 tons, yet many of the piles settled several inches under loads of 35 or 40 tons.

Tapered steel piles driven 35 or 45 ft. into the plastic clay developed a resistance corresponding to a set requiring one or two blows per inch of the No. 1 hammer. When allowed to "rest" one to three hours the piles required two to three times as many blows per inch to redrive and some piles, redriven after 24 hr., required four to five blows per inch for further penetration. Yet several of these piles were pushed down under test loads of 20 to 35 tons.

A large rebound of the piles under each hammer blow characterized the driving in all parts of the site and at

all depths except when the pile point rested in the boulder clay immediately over the rock. Graphical records of the driving of both tapered and cylindrical steel piles showed a rebound of ½ to 1 in. on each blow, while the record of blows required to produce 1 ft. of penetration varied from 40 to 90. The rebound was not generally visible to the eye, its presence being disclosed through use of simple devices for securing a graphical record of the blows.

The safe load capacity of piles that did not penetrate to the boulder clay, as determined by loading tests, roughly corresponds to the capacity computed by several common formulas using the total penetration per hammer blow instead of the "set." In fact, the agreement is sufficiently close to suggest that instead of using the "set" per blow the total penetration per blow should be used in the formulas to secure more accurate results—if any formulas can be used to compute the safe load for piles driven into cohesive soils.

Tests loads applied

Throughout the job more than 100 piles were load tested. To assure accuracy of results a 200-ton hydraulic jack was used, which had been calibrated and equipped with a pressure gage reading directly in tons of load. Light lubricating oil was used to operate the jack, pressure being obtained by either a hand- or engine-operated pump. The jack reaction was secured through a load of 110 to 150 tons of slab and billet steel piled on an I-beam frame. When no movement of the piles was noted under the required test load in 2 to 4 hr., they were considered satisfactory.

Because of the great length of pile necessary and the resistance to driving encountered, steel pipe piles were required. Largest piles were a row of 16-in. O.D. ⅜-in. wall thickness pipe driven on the river side of a steel sheetpiling bulkhead, which formed the wall of the ore dock. These piles were driven inside the recess formed by the Z-type steel sheetpiling and prior to excavation of the channel. Length varied from 85 to 131 ft. with an average of 100 ft.

A No. 0 Vulcan single-acting pile hammer (7,500-lb. ram, 39-in. stroke, 24,375-ft. lb. blow) was used for the 16-in. piles and the driving continued until the resistance required 100 to 140 blows to penetrate 1 ft. Throughout much of the driving the rebound varied from ½ to ¾ in. per blow; in spots the penetration was almost an inch yet the set was little more than zero. These piles were driven with the expectation of their supporting 100 tons of load, yet under load-test several of them failed to support 150 tons.

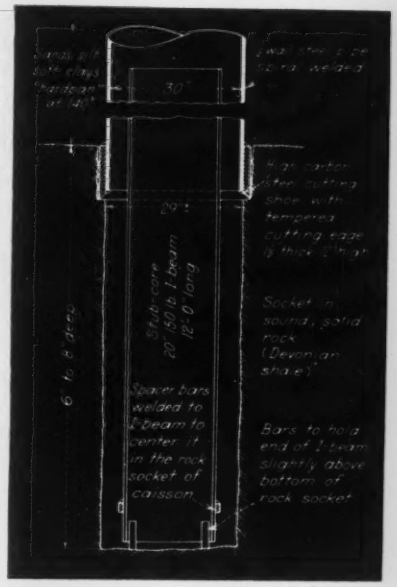

30"
29'-2"
Stub-core
20"-50 lb. I beam
12'-0" long
Socket in sound, solid rock (Devonian shale)
Spacer bars welded to I-beam to center it in the rock socket of caisson
Bars to hold end of I-beam slightly above bottom of rock socket

Fig. 3. Each caisson was driven into rock and a socket was cut 6 to 8 ft. deeper to increase its bearing value.

Most of the piles, 5,016 out of 5,291 used, were 10¾-in. O.D., ¼-in. wall-thickness pipe 100 to 140 ft. long used to support buildings, craneways and miscellaneous structures. The smaller piles were load-tested to 110 tons, held for four hours without settlement, and the safe working load taken as 70 tons per pile.

Cold-formed pipe withstands driving

Generally Grade B electric-weld seam pipe was used. That with the carbon and manganese content held at the top limits and the pipe cold-formed best withstood the hammering. In spite of long hard driving with heavy rams on the end of the thin-wall steel pipe only a very occasional pipe end of the ⅜-in. thickness, and less than 2 percent of the driven length of ¼-in. pipe, was damaged. Hot drawn tubing, however, rolled up badly under the hammers.

The very low percentage of cut-off and damaged pipe was due largely to the use of heavily framed, rigid pile-driving rigs whose operation was directed by men of long experience. Great care was exercised to keep the hammer ram always striking exactly in line with the axis of the pile and with the blow centered directly over the pile section. Deviation in hammer alignment or the striking of a blow off-center would roll the pipe into tight corrugations as often as the pipe end was cut off.

About 650 pipe piles, set on a batter to resist side-thrust, and a few other piles were driven with the 5,000-lb. ram hammer. Use of the large 7,500-lb. ram hammers greatly expedited the work, however, and made it feasible to push the pipe through

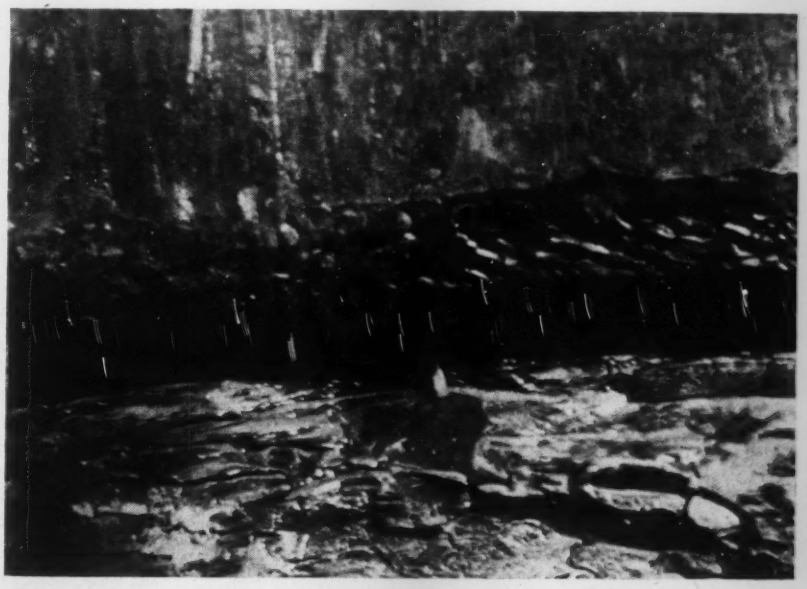


Fig. 4. Steel cutting shoe of drilled-in caisson in contact with shale foundation.

the deep layers of highly plastic and incompressible clays to the mantle of boulder clay overlying the rock.

All of the pipe piles were driven with closed ends, except a few experimental ones and 52 that were cleaned out by well-drilling methods to eliminate the heaving of the soil in an adjacent deep excavation for a blast furnace skip-pit. Pile points consisted of flat steel plate welded to the lower end of the first length of steel pipe. In some instances a shallow ring made from cut-off pieces of pipe was attached to the point to overcome a tendency of the pile to deflect away from the piles previously driven.

Pipe came to the job in double-random lengths of 35 to 45 ft. and were joined in the field. Splices were made as the pile was driven, and consisted of outside steel plate bands electric-welded top and bottom to the two lengths of pipe after the pipe ends had been tightly butted together. The splice bands were attached to the lower end of the pieces as the pipe lay in a horizontal position. As driving proceeded and additional pipe was necessary it was set in the leads and welded to the section below, a skilled welder requiring only 6 to 10 min. to attach a joint. Pipe cut-offs as much as 5 ft. long were butt-welded at carefully squared joints, reinforced with sleeve-bands and used to make up the varying lengths required. None of the field splices failed under even the longest and hardest drives. Piles were completed by filling with 3,000 to 5,000-lb. strength crushed-slag concrete.

Drilled-in caissons support furnace

The structure of a 1,200-ton blast furnace towering 200 ft. above its base required a firm and unyielding foundation. All danger of tipping and movement away from the connecting accessory structures had to be eliminated under any conditions of loading and wind. Considering the very plastic nature of the clays 100 to 135 ft. below the footing, only a foundation resting on the bedrock would provide the desired stability. Steel-pipe piles or caissons offered the only economic solution.

Drilled-in caissons were chosen both for their positive load transfer into the bedrock and because the amount of steel required would be less than for a ¼-in. wall steel-pipe pile foundation even though the piles were loaded to 70 tons each. Some 330 tons of steel were saved by using 25 pipe caissons instead of pipe piles.

The caissons used were 30-in. O.D. ½-in. wall spiral-welded steel pipe driven open-end to rock. The lower end of the pipe was reinforced with a 1½-in. thick, high carbon steel cutting shoe, and driving was done with the single-acting, 7,500-lb. ram hammer. Clays inside the pipe were removed by well drilling methods in which the material was cut and mixed with water and then bailed out.

After the caisson reached rock, a socket the size of the inside of the pipe was drilled into the stone and the heavy hammer used to drive the pipe on down a few inches for a positive connection. The socket inside the caisson was continued 6 to 8 ft. into the bedrock and, after cleaning and washing, visual examination was made by an inspector lowered into the hole. Inspection was made difficult by a considerable flow of natural gas encountered in nearly every one of the caissons, especially at the surface of the rock. At times it was impossible to cut off the flow and fresh air was forced into the bottom of the shaft to purge it of gas. When this was not entirely effective an oxygen mask was used by the inspector who always carried a miner's safety lamp.

The 140-ft. deep caissons were found never to be more than one foot out of plumb nor was the curvature in the 140-ft length ever more than 3 or 4 in. Since the soil was removed, rather than pushed aside, no heaving or displacement of the adjacent foundations took place as was the case where the piles were driven. It required an average of five 10-hr. shifts to construct one caisson, the foundation being completed in the same time that would have been required for the driving of an equivalent steel pipe-pile foundation.

Transfer to rock of the load carried by the caisson shell was accomplished by a 12-ft. length of steel H-beam having a cross-section area slightly greater than that of the steel wall of the shell. The H-beam was set in the rock socket and extended above the enlarged cutting edge, which was also driven to considerable bearing. Concrete carried much of the load directly, and the rest was transferred, from the steel to the rock socket by bond of the concrete.

Each of the 30-in. dia. caissons supports a load of 850 tons, the loading being limited to this amount to reduce the core steel to a short piece at the key to rock. Supporting 850 tons on a 30-in. dia. area imposes an average load of only 2,400 psi. on the entire caisson. If $\frac{1}{16}$-in. thickness of the steel shell is assumed for corrosion loss, although none is likely to take place, and if the net area of the steel pipe is assumed to be loaded to 20,000 psi., the concrete enclosed within the ½-in. band of steel is loaded to only about 1,200 psi.

Filling the caisson with concrete was preceded by dropping a small batch of 1:2 cement-sand mortar into the 140-ft. deep shaft to cover the bottom of the rock socket. The shell was then completely filled with 4,000-lb. strength crushed-slag concrete.

A reinforced concrete mat over the group of caissons supports the blast furnace load.

The drilled-in caisson offers an especially valuable and dependable support for a towering blast furnace structure since it is in effect an extension of the superstructure into bedrock. Anchoring of the caisson to the sound, solid rock makes it capable of resisting all types of stress that may be in the blast furnace structure whether they be torque, tension, compression or the impact of a 30-ft. dia. 100-ft. high column of ore and iron, suddenly dumped.

Acknowledgments

The pipe-pile and drilled-in caisson foundation was constructed for the Defense Plant Corp. for which Republic Steel Corp. acted as agent. Leonard Larsen is chief engineer of the work for Republic and in charge of the design and building of the plant. Lloyd M. Kniffin, now principal engineer for the Defense Plant Corp., was the project engineer at the time the work described was undertaken. K. Terzaghi and R. B. Peck were employed by Republic Steel Corp. as consultants on soil and foundation problems.

The work of driving the piles and building the caissons was performed by Western Foundation Co. with Owen Gourley as superintendent in charge of pile driving and Charles Franc in charge of the caisson construction. The writer represented the contractor as consulting engineer and coordinator in charge of the work. The caissons were built under a license from the Drilled-in Caisson Corp., owner of the Thornley patents for the caissons.

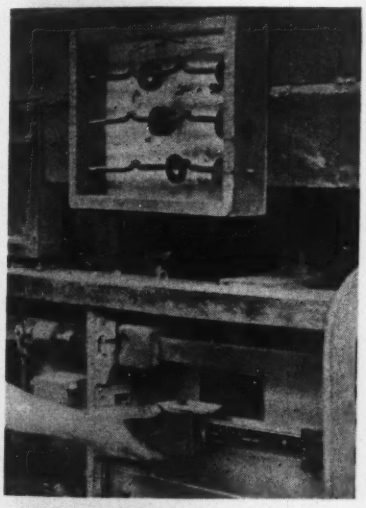
From Field and Office

WORKING PROBLEMS AND TIME-SAVING METHODS FOR ENGINEERS AND CONTRACTORS

Washers Count Concrete Batches

Operator of a concrete mixer at the Pit 5 powerhouse of the Pacific Gas and Electric Co. found it more convenient to move washers on a rack than to pick up a pencil and make tally marks on a concrete batch record. The washers could be moved readily, even when gloves were worn, as was the case during winter months.

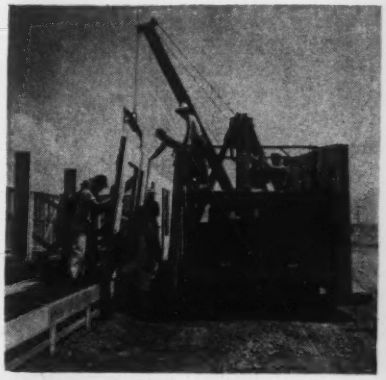
The heavy steel wires used to support the washers were kinked to separate the central or "scoring" zone from that part of the rod where the washers were kept. A washer diameter of 1½ in. was a convenient size. By putting nine washers on the two lower wires (a smaller number was needed on the top line) even on the busiest days a transfer of the records to written reports was required only once a day.



Iron washers on three steel bars simplify record keeping.

Truck Serves Double Purpose in Handling Building Sections

Time was saved on a mass housing project near Spokane, Wash., by a timber frame built around a truck so as to provide a projecting shelf at convenient height on each side on which prefabricated sections of the buildings could be transported. A derrick boom mounted on the rear of the truck body was used to pick up the sections, with the aid of a spreader, when loading the truck and also when placing them in their exact position in the building.



Prefabricated wall sections are delivered and set accurately in position by this specially equipped truck.

When the sections on one side had been delivered the truck was turned around and "spotted," successively, in position for placement of the remaining panels.

Finding Partial Area of an Ellipse

In computing final estimate quantities for elliptical arch bridges, frequently the New York State Division of Highways has had to obtain the area of part of an ellipse. The following method has proved to be the most direct:

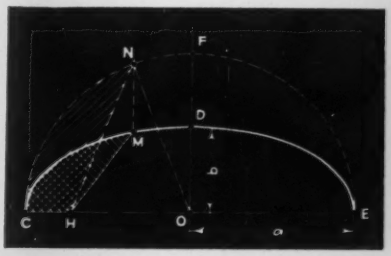
Given the ellipse *CDE* shown in the accompanying sketch, in which *a* is the semi-major axis and *b* is the semi-minor axis, find the area of the shaded portion *CMH* of the ellipse.

The semicircle *CFE* is described upon the major axis of the ellipse as a diameter with the center at *O*. Point *M* on the ellipse is projected at right angles to the major axis to Point *N* on the semicircle. The required area is then given by the equation:

$$\text{Area } CMH = \text{Area } CNH \times \left(\frac{b}{a}\right)$$

The area of section *CNH* of the circle can be found by subtracting the area of the Triangle *HNO* from the area of the Sector *CON*. The value of this method lies in the fact that partial areas of a circle can be readily obtained.

The equation is true because of the property that if a circle be described upon the major axis of an ellipse as diameter, each ordinate in the ellipse is to the corresponding ordinate in the circle as *b* is to *a*. This statement is proven by a consideration of the following relationship. The ordinates of an ellipse are given by $y = \frac{b}{a}\sqrt{a^2 - x^2}$ and the ordinates of a circle are given by $y = \sqrt{a^2 - x^2}$ In fact, the ellipse may be defined as the locus of points dividing the ordinates of a circle in a constant ratio.—WILLIAM E. COOPER, *New York State Division of Highways, Babylon, N. Y.*

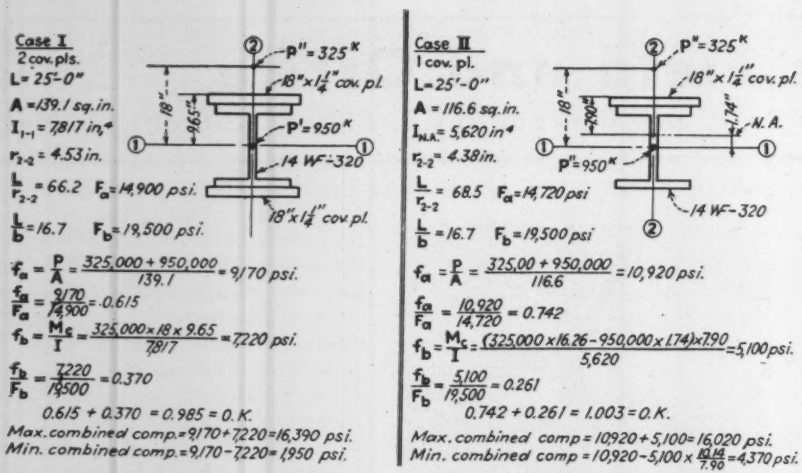


Area of a section of an ellipse may be found very quickly by sketch above and method outlined.

Unsymmetrical Sections For Columns With Eccentric Loads

The usual procedure in selecting column sections for loads for which the heaviest rolled section will not alone suffice is to rivet or weld the same size cover plate to each flange. This practice is satisfactory for concentric loads, but may result in an uneconomical design for eccentric loads, as shown by the accompanying sketches and calculations.

Case I shows an apparently economical design using two symmetrically placed cover plates. In Case II, with the same loads, the plate on the opposite flange to the eccentric load has been omitted, the rest of the sec-



By selecting an unsymmetrical section more economical designs are often possible for columns with eccentric loads. Symmetrical and unsymmetrical designs for a typical example are compared above.

tion remaining unchanged. The result shows both sections complying closely with the A.I.S.C. code; the lighter one having slightly less maximum combined stress.

Similar savings also may be made with all-welded column sections by appropriate use of unsymmetrical flanges for eccentric loads—PAUL FISHER, *Kingsport, Tenn.*

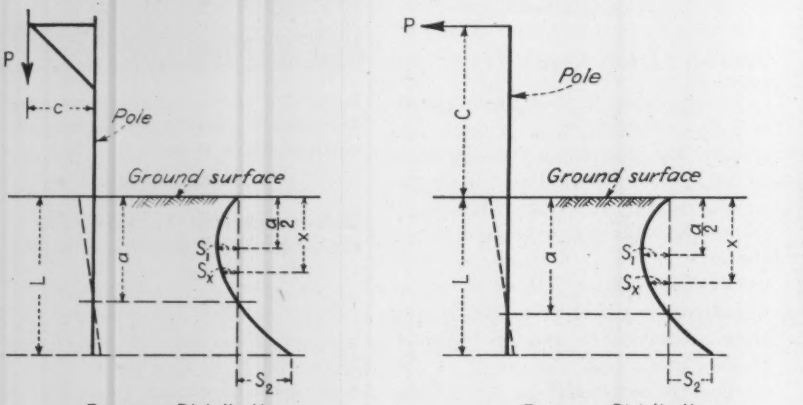
EARTH PRESSURES ON EMBEDDED POLES

Poles or other vertical members embedded in the ground are sometimes subjected to cantilever action by a load acting either horizontally or vertically. To find the distribution of horizontal pressure on the soil induced by such action the formulas shown in the accompanying drawing often prove useful. In using the formulas the dimensions are to be expressed in feet, the load P in pounds, and S in pounds per square foot.

Case I is applicable to poles supporting a vertical eccentric load, and Case II to poles subjected to a horizontal force. The formulas are based on the common assumption that the lateral passive resistance of the earth varies directly as the depth of embedment, which is assumed in determining the required embedment of sheetpiling and would seem a reasonable assumption with poles. Further, it is assumed that the lateral resistance varies as the distance from the neutral axis or point of no movement.

The formulas are based on a pole diameter of one foot. For any other size pole divide S by the pole diameter represented in feet.

The formulas are considered applicable to both granular and plastic (sand, gravel or clay) soils inasmuch as both types behave roughly as elastic solids within a certain range of pressure.—*Paul Fischer, office engineer, Chas. T. Main, Inc., Kingsport, Tenn.*



Horizontal soil pressures caused by poles with eccentric or horizontal loads may be determined by above formulas.

Seat With Rollers Aids Welder

Welders made better speed and worked with less fatigue in spot welding bolts on the underside of a box girder when provided with a seat mounted on casters. The base, made of 2-in. scrap lumber, resembled a small box, open side down, with casters in the four corners. The upright was a piece of timber cut to convenient length.

The device was made up by the construction organization of the J. H. POMEROY & CO., INC., *San Francisco.*

Stool with casters increases welders output.

MAKES ITS OWN ROADS AS IT TRAVELS!

1 Saves Vital Road Machines

2 Keeps Jobs on Schedule

3 Works in Wet Weather & Mud

ATHEY Forged-Trak Trailers conserve vital roadbuilding and road-maintaining outfits. It isn't necessary to construct smooth haul roads where these units are working. In itself, this is a saving of construction machines and manpower which are in great demand in the nation's Victory program.

Wherever it goes, the Athey Trailer lays its own smooth steel highway over which heavy loads roll easily and economically. Its broad tracks operate in soft mud, sand, snow, rock or loose earth, paying little regard for either footing or weather. There's no concentration of the load at one point — but rather a spreading of the weight over wide steel tracks. This provides support for the load in soft footing the same as snowshoes support the weight of a man. Athey Trailers maintain steady production no matter how tough weather or footing may be.

Check these many advantages with your Athey-"Caterpillar" Dealer today. Let him give full facts on the delivery situation of new Athey products. And always see your Athey-"Caterpillar" Dealer when you need repair service. Athey Truss Wheel Co., Chicago, Illinois.

ATHEY

Forged-Trak *Wheels*

SURE TRANSPORTATION

CONTRACT UNIT PRICES

What contractors are bidding on different kinds of construction work

SEWERAGE SYSTEM, MORGANFIELD, KY.

OWNER: Federal Works Agency, Chicago, Ill. E. L. Fisher, project engineer.

PROJECT: Sewerage system in Morganfield, Ky., involving construction of sanitary sewers (Section I), and sewage pumping station and sewage treatment plant (Section II). Sanitary sewer section requires trenching ranging from 0 to 24-ft. deep; laying of clay or concrete sewer pipe; cast iron pipe; standard manholes; removal and relaying of pavement; and concrete in piers and pipe cradles. Section II consists of construction of uptown sewage pumping station; sewage treatment plant; and water supply line for the plant.

CONDITIONS: Contractor to furnish all materials and complete work in 120 consecutive calendar days. Rail, highway and water transportation facilities available. Wage rates are: skilled labor, 90c. to $1.625 per hr.; semi-skilled, 75c. to $1.25; and common, 70c. per hour.

BIDS: Six bids were received on each section of the project on July 2, 1943. Range of bids on Section I was from the contract low of $79,526 to $127,391; and on Section II, from the contract low of $73,568 to $92,330.

LIST OF BIDDERS:

1. D. L. Amici Co., Forest Park, Ill. (contract) $79,526
2. Michael Pontarelli & Sons, Chicago, Ill 84,121
3. Birmingham Constr. Co., Birmingham, Mich 94,115

Section I—Sanitary Sewers

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Trenching, 0 to 6-ft. deep	20,563 l. f.	$1.00	$0.55	$1.10
2. Trenching, 6 to 8-ft. deep	8,429 l. f.	1.10	.66	1.25
3. Trenching, 8 to 10-ft. deep	2,688 l. f.	1.30	.83	1.45
4. Trenching, 10 to 12-ft. deep	1,560 l. f.	1.50	1.04	1.50
5. Trenching, 12 to 14-ft. deep	723 l. f.	2.00	1.32	1.95
6. Trenching, 14 to 16-ft. deep	689 l. f.	2.50	1.57	3.25
7. Trenching, 16 to 18-ft. deep	693 l. f.	3.25	3.08	4.25
8. Trenching, 18 to 20-ft. deep	233 l. f.	4.00	4.18	7.70
9. Trenching, 20 to 22-ft. deep	254 l. f.	4.50	5.83	8.40
10. Trenching, 22 to 24-ft. deep	199 l. f.	5.00	8.03	9.45
11. 12-in. clay or conc. sewer pipe	1,979 l. f.	.70	1.26	.80
12. 10-in. clay or conc. sewer pipe	4,923 l. f.	.55	1.10	.70
13. 8-in. clay or conc. sewer pipe	29,047 l. f.	.45	.90	.52
14. Wye branch, 6" on 12" pipe	4 ea.	1.35	3.30	2.10
15. Wye branch, 6" on 12" pipe	29 ea.	1.10	2.75	1.62
16. Wye branch, 6" on 12" pipe	375 ea.	.90	2.20	1.05
17. 12-in. c. i. pipe laid in sewer	60 l. f.	4.00	5.00	2.90
18. 10-in. c. i. pipe, laid in sewer	12 l. f.	3.50	4.00	2.50
19. 8-in. c. i. pipe, laid in sewer	52 l. f.	2.40	3.00	2.20
20. Standard sewer manholes, 6-ft. deep	134 ea.	85.00	100.00	100.00
21. Addition vertical manhole depth	212 ver. f.	10.00	15.00	20.00
22. Take up and relay pavement (black-top)	1,028 s. y.	3.00	2.00	3.00
23. As above; brick pavmt., conc. base	54 s. y.	4.00	4.00	3.50
24. As above; conc. pavmt., 6-in. thick	105 s. y.	4.00	4.00	3.00
25. Class B conc. in piers, incl. forms, bolts and pipe clamps	3 c. y.	30.00	40.00	30.00
26. Class C conc. in pipe encasement and cradles	5 c. y.	20.00	20.00	20.00

Section II—Sewage Pumping Station and Treatment Plant

LIST OF BIDDERS:

1. Buesching Bros. Constr. Co., Fort Wayne, Ind. (contract) $73,568
2. A. C. Rehm, Oak Park, Ill 77,811
3. Birmingham Constr. Co., Birmingham, Mich 83,641

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Excavation (pumping station)	500 c. y.	$6.63	$3.00	$3.00
2. Sewage pumping station	Lump Sum	8,214.00	10,000.00	9,940.00
3. 4-in. c. i. pipe force main (incl. trenching)	1,176 l. f.	1.60	1.50	1.55
4. Excavation (sewage treat. plant)	2,150 c. y.	2.10	1.60	2.20
5. Screen and grit removing strainer	Lump Sum	881.00	1,000.00	1,645.00
6. Sewage pumping station	Lump Sum	14,337.00	15,500.00	12,820.00
7. Imhoff tank and appurtenances	Lump Sum	9,266.00	14,500.00	15,270.00
8. Trickling filter	Lump Sum	19,737.00	18,000.00	21,130.00
9. Final settling tank	Lump Sum	4,645.00	6,000.00	7,715.00
10. Sludge drying beds (one group)	Lump Sum	2,158.00	2,000.00	2,0
11. Trench excavation	350 c. y.	2.22	2.00	
12. 12-in. cast iron pipe	40 l. f.	5.00	4.00	
13. 6-in. cast iron pipe	200 l. f.	2.00	3.00	
14. 2-in. galv. wrt. steel pipe	350 l. f.	.55	.50	
15. 1¼-in. galv. wrt. steel pipe	50 l. f.	.42	.40	
16. 1-in. galv. wrt. steel pipe	10 l. f.	.30	.30	
17. 12-in. sewer pipe	670 l. f.	1.73	1.50	
18. 6-in. sewer pipe	170 l. f.	.70	1.00	
19. 4-in. sewer pipe	25 l. f.	.56	.50	
20. Class B concrete	12 c. y.	27.00	18.00	
21. 1½-in. yard hydrants	2 ea.	47.00	40.00	
22. 1½-in. gate valves and valve boxes	1 ea.	24.00	15.00	
23. Standard manholes (complete)	2 ea.	151.00	100.00	
24. 2-in. galv. wrt. steel pipe for plant water supply line	1,000 l. f.	.78	.70	
25. Connection to existing mains, etc.	Lump Sum	53.00	50.00	

HIGHWAY, FLORIDA

OWNER: State Road Dept. of Florida, Tallahassee; J. Dowling, state highway engineer.

PROJECT: Bituminous surfacing 13.484 miles of State R 79 from a point approximately one mile east of Barto Lake Wales, Polk County, Fla. Involves removal of exis structures; regular excavation; lateral ditch excavation; soil excavation; removal of portion of existing pavement; haul; mixing and compacting materials for roadway; s course Ocala rock base; structural timber and timber pil drainage structures; curbing and guttering; and sidewalk

CONDITIONS: Owner is to furnish all materials and furnish convicts for all common labor. Rail and highway portation facilities available to site of work. Time for pletion: 310 working days.

BIDS: Five bids were received September 14, 1943, ran from the contract low of $289,406 to $327,322.

LIST OF BIDDERS:

1. Marion Contracting Co., Ocala, Fla. (contract) $28
2. Hall & Caddell, Jacksonville, Fla 29
3. J. H. Craggs Constr. Co., Ocala, Fla 29
4. L. J. & W. L. Cobb, Inc., Tampa, Fla 30
5. R. H. Wright & Son, Columbus, Ga 32

Item	Quan.	Unit Prices (1)	(2)	
1. Removal of existing structures (six)	Lump Sum	$2,930.00	$2,680.00	$3,2
2. Regular excavation	196,461 c. y.	.32	.35	
3. Lateral ditch excavation	22,688 c. y.	.36	.40	
4. Subsoil excavation	115,594 c. y.	.60	.56	
5. Remove existing pavement	56,760 s. y.	.10	.08	
6. Overhaul (half-mile cubic yards)	39,172 ½-mi. c. y.	.05	.06	
7. Mixing and compacting mat'ls., roadway (6-in. deep)	9,030 s. y.	.04	.06	
8. Mixing and comp. mat'ls., rdway. (12-in.)	49,464 s. y.	.07	.08	
9. Ocala rock base (single course, 6-in.)	181,326 s. y.	.38	.43	
10. Tar prime material, RT-2	36,265 gal.	.07	.05	
11. Cover material for Type 2	4,813 c. y.	1.90	1.50	
12. Bituminous material (surf. trtmt.)	103,961 gal.	.05	.03	
13. Retread aggregate with mineral seal	441 c. y.	1.90	1.50	
14. Retread bituminous material	10,360 gal.	.06	.03	
15. Untreated struct. timber (cypress)	252.45 Mbm.	75.00	78.00	
16. Concrete, Class A (endwalls)	135.47 c. y.	27.00	25.00	
17. Reinforcing steel	272 lb.	.10	.10	
18. Untreated timber piling (cypress)	6,000 l. f.	.87	.83	
19. Treated timber piling	10,900 l. f.	.87	.83	
20. Timber sheet piling	6.64 Mbm.	75.00	78.00	
21. Inlets, Type BSE, 4 to 6-ft. deep	5 ea.	125.00	135.00	
22. Inlets, Type BRE, 4 to 6-ft. deep	3 ea.	125.00	135.00	
23. Inlets, Type BMRE, 4 to 6-ft. deep	2 ea.	125.00	145.00	
24. Inlets, Type BM2E, 4 to 6-ft. deep	7 ea.	125.00	145.00	
25. Manholes, Type B, 4 to 6-ft. deep	2 ea.	125.00	100.00	
26. Concrete curb (8-in. by 20-in.)	350 l. f.	.67	.70	
27. Concrete curb and gutter	4,937 l. f.	.80	.75	
28. Concrete sidewalk (4-in. thick)	11,743 s. f.	.13	.15	
29. Concrete sidewalk (6-in. thick)	5,678 s. f.	.26	.25	

FOR THE HELPFUL COOPERATION OF THESE FIRMS

We Are Most Appreciative

American Asphalt Pdts. Co.	Great Mills, Md.
American Bridge Co.	New York, N. Y.
Amer. 3 Way-Luxfer Prism Co.	Chicago, Ill.
Albro Metal Products Corp.	Bronx, N. Y.
Alphons Custodis Co.	Chicago, Ill.
Arc Elec. Constr. Co., Inc.	New York, N. Y.
Asbestos Corp., The	Columbus, Ohio
Asplund Constr. Co.	Enid, Okla.
Associated Plastering Co., Inc.	New York, N. Y.
Atlas Tile & Marble Works, Inc.	New York, N. Y.
Augustine Constr. Co.	Phila., Pa.
Automatic Sprinkler Corp. of America	New York, N. Y.
Baker, G. M. and Sons, Inc.	Columbus, Ohio
Ballenger, C. H. Co.	Columbus, Ohio
Bayley, Wm., Company	Springfield, Ohio
Beasley, John F., Constr. Co.	Muskogee, Okla.
Bethlehem Contracting Co.	Bethlehem, Pa.
Boso & Ritchie, Inc.	Ravenswood, W. Va.
Broadway Elec. Construction	New York, N. Y.
Brown & Kerr	Chicago, Ill.
Bugbee, A. Newton, Co.	Catasauqua, Pa.
Calbi, Carlos	Bethlehem, Pa.
Cement Gun Co.	St. Louis, Mo.
Cenci, Nick	Columbus, Ohio
Denty, W. S.	McAlester, Okla.
Electric Power Equip. Co.	Columbus, Ohio
Eurell, J. B., Co.	Philadelphia, Penn.
Flynn, Michael, Mfg. Co.	New York, N. Y.
General Bronze Corp.	Chicago, Ill.
Gentile, Al.	Phila, Pa.
Gurtler, W. A. Company	Chicago, Ill.
Harlein Products, Inc.	Orchard Park, N. Y.
Hatzel & Buehler, Inc.	New York, N. Y.
Hass Co., J. I., Inc.	Jersey City, N. J.
Heating Maintenance Corp.	New York, N. Y.
Hershock, C. H.	Harrisburg, Pa.
Holt, W. H., & Son	Columbus, Ohio
Huffman-Wolfe Co., The	Columbus, Ohio
Jack Constr. Co.	Kansas City, Kansas
Jarcho Bros., Inc.	New York, N. Y.
Johnson, John A., and Sons, Inc.	Brooklyn, N. Y.
Keasbey, Robert A., Co.	New York, N. Y.
Kelly, John B., Inc.	New York, N. Y.
Kendrick, C. A. Company	Buffalo, N. Y.
Kenmar Steel Constr. Co.	Washington, D. C.
Klaas Bros.	Tulsa, Okla.
Kosson and Sons, Inc.	Passaic, N. J.
Law Pipe Railing Corp.	L. I. City, N. Y.
Lewis & McDowell, Inc.	New York, N. Y.
Merry Screen Co.	Tulsa, Okla.
Midwest Marble & File Co.	Tulsa, Okla.
Miller, H. E.	Columbus, Ohio
Munro Waterproofings, Inc.	New York, N. Y.
Moreira and Caiado	Ozone Park, N. Y.
Nicely Corp., The	Philadelphia, Pa.
Nylander, C. F.	Chicago, Ill.
Otis Elevator Company	New York, N. Y.
Pelham Painting Co.	New York, N. Y.
Pittsburgh Plate Glass Co.	Brooklyn, N. Y.
Railroad Waterproofing Corp.	Lynbrook, N. Y.
Raymond Concrete Pile Co.	New York, N. Y.
Richmond Fireproof Door Co.	Richmond, Ind.
Ringwald, W. H., & Sons, Co.	Chillicothe, Ohio
Robertson, H. H., Co.	Pittsburgh, Pa.
Rolfsen Painting Corp.	New Rochelle, N. Y.
Rosenthal, Earl O.	Brooklyn, N. Y.
Saia, A. J.	New York, N. Y.
St. Louis Lighting Co.	St. Louis, Mo.
Stutz Contracting Co., Inc.	Bronx, N. Y.
Staples Construction Co.	New York, N. Y.
Supreme Decorating Corp.	Brooklyn, N. Y.
Tallmadge, Alvan	Columbus, Ohio
Tedaldi, D. J., Construction Co.	Bronx, N. Y.
Texas Automatic Sprinkler Co.	Dallas, Texas
Thorn, J. S., Co.	Philadelphia, Pa.
Triangle Contracting Co.	Newark, N. J.
Tully & Di Napoli, Inc.	L. I. City, N. Y.
Vaught, R. W. Plbg. & Htg. Co.	Camdenton, Mo.
Vinje Weatherstrip & Caulking Co., Inc.	Bklyn., N. Y.
Wander Iron Works, Inc.	New York, N. Y.
Wege Marble & Tile Co., The	Columbus, Ohio
Western Waterproofing Co.	New York, N. Y.
Wiedenmann, W. C. and Son	Kansas City, Mo.

CORBETTA CONSTRUCTION COMPANY, INC.

EXECUTIVE OFFICE: 220 EAST 42nd STREET, NEW YORK, N. Y.

PAVING AND BRIDGE, PENNSYLVANIA

OWNER: Board of Commissioners, Allegheny County, Pittsburgh, Pa.; Levi Burd Duff, engineer.

PROJECT: Paving McKnight Road (Section 4), bituminous penetration base course with 2-in. asphalt wearing surface for portion of project; and special one-course concrete (Class P), 12-in. thick, for the balance of the project. Also constructing reinforced concrete bridge at Babcock Boulevard Interchange, Ross Township, Allegheny County, Pa. Work includes necessary excavation, embankments, curbing, gutters, traffic islands, center strip paving, drainage structures, waterlines, etc.

CONDITIONS: Contractor to furnish all materials. Rail, highway and water transportation facilities available to Pittsburgh, and highway to site of work. Wage rates in the Pittsburgh area are: $1.75 to $1.90 per hour for skilled labor, and 80 to 90c. per hour for common.

BIDS: Six bids were received September 7, 1943, ranging from the contract low of $338,237 to $439,909.

LIST OF BIDDERS:

1. Frank Donatelli & Sons, Pittsburgh, Pa. (contract) ..$338,237
2. Sanctis Constr. Inc., Pittsburgh, Pa 355,881
3. Yorktown Constr. Co., New York, N. Y. 366,331
4. McCrady Constr. Co., Pittsburgh, Pa 403,044
5. Dinardo, Inc., Pittsburgh, Pa 423,753
6. Melwood Constr. Corp., New York, N. Y. 439,909

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Class I excavation	64,000 c. y.	$0.50	$0.55	$1.00
2. Remove, dispose of underground brick	20 c. y.	3.00	5.00	10.00
3. Refilling, granulated slag	5,000 c. y.	1.25	2.00	1.80
4. Embankment, granulated slag	4,000 c. y.	.50	1.50	1.00
5. Concrete, Class A-M	5,000 s. f.	.23	.35	.35
6. Conc., Cl. P, special 1-crse. pavmt., 12-in. thick	13,000 s. y.	3.75	3.75	3.70
7. Conc., Cl. P-M, pavmt. in center strip, incl. all steel reinforcing	1,000 s. y.	3.75	4.00	2.80
8. Concrete, Cl. A-M curb	4,500 l. f.	1.45	1.75	1.50
9. Cl. A-M conc. curb with underdrain and 6-in. perf. clay pipe	500 l. f.	2.00	2.75	2.00
10. Spec. conc. curb, Class A-S	300 l. f.	3.00	4.25	1.50
11. Spec. conc. guard curb, Class A-S	3,000 l. f.	2.50	1.25	1.50
12. Class B conc. endwalls and footers	18 c. y.	31.00	50.00	20.00
13. Cl. P conc. berm gutter, type 2	800 s. y.	3.25	3.50	3.00
14. Class A-M concrete traffic islands	3 c. y.	31.00	25.00	75.00
15. Bitum. penetration base crse (8-in.), with 2-in. asph. wearing surf	1,000 s. y.	3.00	3.75	3.40
16. Cold mix asph. surf. crse., fine aggr.	25 ton	11.00	14.00	12.00
17. Wood post barrier	400 post	7.00	6.50	5.00
18. 12-in. rein. conc pipe culvert	300 l. f.	3.00	2.50	2.00
19. 15-in. rein. conc. pipe culvert	340 l. f.	3.50	3.00	2.20
20. 12-in. clay pipe culvert	300 l. f.	2.85	2.00	1.50
21. 15-in. clay pipe culv. or sewer	800 l. f.	2.75	2.50	2.00
22. 18-in. clay pipe culvert	900 l. f.	3.25	3.50	2.50
23. 15-in. clay culv. curves, 45-deg.	4 ea.	5.00	7.50	10.00
24. 18-in. by 15-in. clay wyes	3 ea.	13.00	18.00	10.00
25. 18-in. by 12-in. clay wyes	5 ea.	8.00	10.00	10.00
26. 15-in. by 15-in. clay wyes	2 ea.	9.00	15.00	10.00
27. 15-in. by 12-in. clay wyes	3 ea.	7.00	10.00	10.00
28. Brick catchbasins, type 6 or 6-A	2 ea.	180.00	160.00	40.00
29. Spec. brick catchbasins, type 6 or 6-A	2 ea.	170 00	145.00	40.00
30. Brick storm inlets, type 5	3 ea.	135.00	145.00	40.00
31. Special brick storm inlets, type 5	3 ea.	125.00	125.00	40.00
32. Brick storm inlets, type 6 or 6-A	8 ea.	150.00	150.00	40.00
33. Spec. brick storm inlets, 6 or 6-A	8 ea.	140.00	120.00	40.00
34. Brick manholes	2 ea.	120.00	150.00	200.00
35. Special brick manholes	2 ea.	110.00	120.00	200.00
36. Trapped brick manholes	1 ea.	200.00	160.00	250.00
37. Special trapped brick manholes	1 ea.	195.00	150.00	250.00
38. Extra depth catch basins	10 l. f.	25.00	20.00	10.00
39. Extra depth manholes	10 l. f.	40.00	20.00	10.00
40. Malleable iron gratings	4 ea.	24.00	25.00	30.00
41. Wood gratings for endwalls	3 ea.	25.00	15.00	20.00
42. Underdrain with 6-in. perf. clay pipe	3,000 l. f.	1.25	1.00	1.00
43. Cl. B conc. encasement for 15-in. clay pipe	120 l. f.	3.25	2.25	1.50
44. Topsoil, in place	2,000 s. y.	.65	.60	.60
45. Grass seeding, in place	2,000 s. y.	.15	.30	.18
46. Contractors' tools, plant, equip., etc.	Lump Sum	25,625.00	20,000.00	17,000.00
47. Maintain Evergreen Rd. traffic	Lump Sum	700.00	1,000.00	3,500.00
48. 8-in. centr. b. & s. Class 250, cement lined cast-iron pipe	48 l. f.	4.50	3.00	6.00
49. As above, 6-in.	24 l. f.	4.25	2.50	6.00
50. 8-in. Class D cast iron pipe	150 l. f.	3.00	2.00	6.00
51. 6-in. Class D cast iron pipe	465 l. f.	2.75	2.00	1.40
52. 1-in. brass ferrule, drain connection	1 ea.	3.00	12.00	10.00
53. 8-in. hub gate valves	1 ea.	95.00	75.00	75.00
54. Resetting fire hydrant	1 ea.	25.00	50.00	100.00
55. Cast iron frames and covers	3 ea.	30.00	30.00	50.00
56. Brick work on water lines	7 c. y.	60.00	40.00	45.00
57. Conc. and appurtenant work (water lines)	7 c. y.	60.00	18.00	20.00
58. Additional excavation	10 c. y.	3.00	2.50	10.00
59. Miscellaneous steel	200 lb.	.15	.15	.30
60. Excavation, Class 2 (bridge)	3,300 c. y.	1.50	1.50	4.00
61. Concrete (Cl. A and A-a) for bridge superstructure below rdwy. slab	460 c. y.	31.00	45.00	24.00
62. Cl. B conc. for footers, abutments and wing walls	4,200 c. y.	19.00	18.00	22.00
63. Conc. Cl. A-M for sidewalk on struct., incl. fascio and intermed. beams	1,490 s. f.	3.25	3.00	1.00
64. Conc. Cl. A-S, for guard on curb	190 l. f.	3.00	1.00	1.50
65. Medium carbon steel	3,500 lb.	.10	.20	
66. Malleable iron castings	48,000 lb.	.46	.55	
67. Steel reinforcing bars	550,000 lb.	.05	.06	
68. Wood railing	460 l. f.	2.25	3.00	
69. Malleable iron posts for railing	5c ea.	.58	.65	
70. Rail, malleable iron incl. posts	460 l. f.	14.50	16.00	
71. Bridge floor, conc., Cl. A-M	430 s. y.	12.00	15.00	

BRIDGE, WISCONSIN

OWNER: State Highway Commission of Wisconsin, Madi
C. H. Kirch, bridge engineer.

PROJECT: Construction of Water Street Bridge in Spa
Wis., on State Trunk Highways 27 and 71. Substructure
floor of bridge are concrete; steel I-beam span superstruct
Length is 62½-ft.; width between curbs is 46-ft., with
ten-ft. sidewalks.

CONDITIONS: Contractor to furnish all materials. Exc
tion and all concrete work (substructure) to be compl
in 215 days; steel work and superstructure to be complete
90 days. Rail and highway transportation facilities avail
to site of work. Wage rates are: skilled labor, $1.25 to $
per hour; semi-skilled, 85c. to $1.60; common, 90c. to $1

BIDS: Six bids were opened October 29, 1943, ranging f
the contract low of $56,943 to $77,955.

LIST OF BIDDERS:

1. I. H. Pertzsch, Onalaska, Wis. (contract) $56
2. C. R. Meyer & Sons Co., Oshkosh, Wis. 72
3. Wausau Constr. Co., Wausau, Wis 7
4. C. B. Taylor, Decorah, Iowa 7
5. Brennan Bros., Lansing, Iowa 7
6. Eau Claire Engr. Co., Eau Claire, Wis 7

Item	Quan.	Unit Prices (1)	(2)	
1. Excavation for structures	1,715 c. y.	$5.00	$7.20	$
2. Excavation for structures	1,385 c. y.	1.00	7.00	
3. Concrete masonry	664.1 c. y.	25.00	28.14	
4. Concrete masonry	380 c. y.	25.00	20.90	
5. Bar steel reinforcing	34,480 lb.	.06	.0608	
6. Bar steel reinforcing	12,700 lb.	.06	.0492	
7. Structural steel	145,700 lb.	.067	.064	
8. Mortar rubble masonry	12 c. y.	15.00	12.00	
9. Untreated timber test pile	Lump Sum	200.00	313.06	4
10. Untreated timber piling	4,500 l. f.	.96	.865	
11. Untreated timber piling	2,610 l. f.	.90	.865	
12. Floor drains	4 ea.	20.00	16.00	
13. Membrane waterproofing	270 s. f.	.25	.40	
14. Membrane waterproofing	158 s. f.	.25	.40	
15. Structural steel (railing)	10,170 lb.	.13	.18	

ROADWAY PAVING, TENNESSEE

OWNER: Tennessee Dept. of Highways, Nashville.

PROJECT: Concrete paving 12.724 miles of highway loc
between Shelbyville and the Coffee County Line in Bed
and Moore Counties, Tenn. Includes all necessary roadway
drainage excavation, 8-in. uniform plain concrete paveme
timber guard posts, concrete grade crossing, and either crus
stone or gravel for traffic bound roadway. Award made
basis of gravel for the latter item.

CONDITIONS: Contractor to furnish all materials and c
plete work in 60 working days. Rail and highway transpo
tion facilities available. Wage rates are: skilled labor, 75
$1.25 per hour; semi-skilled, 45 to 75c.; common, 30 to

BIDS: Seven bids were opened September 24, 1943, ran
from the contract low of $392,541 to $483,354.

LIST OF BIDDERS:

1. H. E. Wolfe Constr. Co., St. Augustine, Fla. (contract) $39
2. Foster and Creighton Co., Nashville, Tenn 42
3. Weymouth Constr. Co., Memphis, Tenn 43
4. Pittman Constr. Co. & Stacy Bros. Co., Atlanta, Ga., and Johnson City, Tenn 43
5. Polk Smart Paving Co., Chattanooga, Tenn 45
6. T. M. Strider & Co., Nashville, Tenn 47
7. Bowyer & Johnson, Jackson, Tenn 48

Item	Quan.	Unit Prices (1)	(2)
1. Roadway and drainage excav. (uncl.)	31,866 c. y.	$0.30	$0.40
2. Plain cem. conc. pavmt. (8-in. uniform)	165,890 s. y.	2.21	2.39
3. Furn. and set timber guard posts	4,819 ea.	3.00	2.25
4. Concrete, grade crossing	178 s. y.	5.00	4.50
5. Traffic bound roadway alternate, rushed stone	370 c. y.	.....	.....
6. Traffic bound roadway alternate, gravel	370 c. y.	2.75	3.00

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IN TOUGH HEAVY-DUTY SERVICE

Full speed ahead to full reverse in 3 seconds . . . *no other clutch could do it!*

This tug—typical of hundreds of Navy and Merchant Marine vessels—is proving every day that the Fawick Airflex Clutch handles heavy service jobs with entirely new standards of efficiency and economy.

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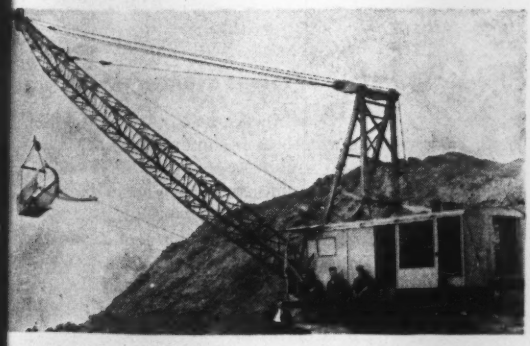
For any heavy-duty application—on any machine—send us details and we'll gladly recommend the Fawick Clutch or Brake that best fills the need.



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Where heavy loads are handled—where clutch must be engaged and disengaged quick and often, Fawick Airflex Clutches are superior to all other types, for dependable and economical service.

12 IMPORTANT ADVANTAGES

1. Simple in design and operation.
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4. Dampens vibration—absorbs shocks.
5. Corrects misalignment automatically.
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7. Runs cooler—uniform pressure.
8. Controls torque by air pressure.
9. Greater capacity—more compact.
10. Remote control by air valve.
11. Replaces couplings.
12. Acts as clutch, slip-clutch or brake.

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CALIF..San Francisco & Los Angeles—J. D. Adams Co.
Redding—J. G. Bastain
COLO...Denver—McKelvy MachineryCompany
CONN..New Haven—W. I. Clark Company
D. C....Washington—Paving Supply & Equipment Co.
FLA....Jacksonville & Miami—Florida Equipment Co.
Tampa—Orange State Motor Co.
GA.....Atlanta—Tri-State Culvert & Machinery Co.
IDA....Boise & Pocatello—Intermountain Equipment Co.
ILL.....Peoria & Springfield—A. E. Hudson Company
Salem—Glasco Tractor & Equipment Company
Chicago—Great Lakes Supply Corp.
IND....Indianapolis—J. D. Adams Company
Newburgh—Matt W. Foster
IOWA...Des Moines—Herman M. Brown Company
KANS...Wichita—S. H. Denney Road Machinery Co.
KY.....Louisville—Brandeis Machinery & Supply Co.
LA.....Baton Rouge—Industrial Tractor & Equip. Co., Inc.
MAINE.Portland—Maine Truck-Tractor Co.
MD.....Baltimore—Paving Supply & Equipment Co.
MASS..Newton Highlands—Tractors, Inc.
MICH..Bark River—Bark River Bridge & Culvert Co.
Detroit & Grand Rapids—J. D. Adams Company
MINN..Minneapolis & Duluth—Thorman W. Rosholt Co.
MISS...Jackson—Mississippi Road Supply Co.
MO.....St. Louis—Missouri-Illinois Tractor & Equip. Co.
Kansas City—Noel V. Wood, Inc.
MONT..Billings—Industrial Equipment Company
NEB....Omaha—Nebraska Tractor & Equipment Company
NEV....Reno—Allied Equipment, Inc.
N. H....Chester—R. C. Hazelton Co.
N. J....Trenton—Rose, Young, Dilts Corp.
N. M...Albuquerque—McChesney-Rand Equip. Co., Inc.
N. Y....Groton—Clapp Machinery Company
Buffalo—Dow & Company, Inc.
Brooklyn—Edward Ehrbar, Inc.
Long Island—George Malvese & Co.
Albany—Slade Tractor Co., Inc.
N. C....Raleigh—J. B. Hunt & Sons
N. D....Fargo—Myhra Equipment Company
OHIO...Cleveland—Gibson-Stewart Company
Cincinnati—H. P. Kelly Equipment Co.
Cambridge—C. E. Major
OKLA..Tulsa & Guthrie—C. L. Boyd Company, Inc.
ORE....Portland & Eugene—Howard-Cooper Corporation
PA.....Butler—National Culvert & Equipment Co.
Pittsburgh—Russell Pipe & Foundry Company
Camp Hill—L. B. Smith, Inc.
R. I.....Providence—Tractors, Inc.
S. C....Columbia—N. H. Summers Road Machinery Co.
S. D....Sioux Falls—Empire Equipment Company
TENN..Knoxville—Brooks Equipment & Mfg. Co.
Nashville—Industrial Tractor & Equipment Co., Inc.
Memphis—Road Builders Equipment Co.
TEXAS..Dallas & Houston—Browning-Ferris Machinery Co.
San Antonio—Jess McNeel Machinery Co.
Plainview—Plains Machinery Company
UTAH...Salt Lake City—The Lang Company
VT.....Montpelier—Vermont Road Equipment Co.
VA.....Richmond—Municipal Sales Company
Roanoke—Roanoke Tractor & Equipment Corp.
WASH..Spokane, Seattle, Walla Walla—
Howard-Cooper Corporation
W. VA..Charleston—Charleston Tractor & Equipment Corp.
WIS....Eau Claire—Bark River Bridge & Culvert Co.

SEE **Adams**
AD ON OPPOSITE PAGE

NEW AIDS TO THE CONSTRUCTOR

Non-Corrosive Paper

The problem of packaging machine parts for overseas transport has led to the development of KD8-C-17 greaseproof, non-corrosive wrapping paper. Said to protect parts against corrosion, salt water, climatic and atmospheric pressure the paper meets all government specifications, and has been approved by the Forest Laboratories.

This paper, in addition to withstanding rough handling, permits speed and ease of wrapping. It may be heat-sealed into bags, and is available in a range of stock sizes, ready for immediate delivery. A sample will be sent on request.—*Criterion Paper & Twine Co., 345 West 36th St., New York 18, N. Y.*

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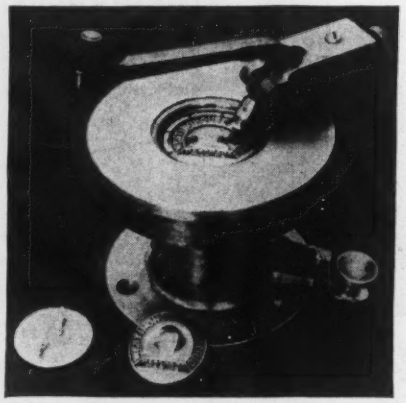
Badge Opener

Backs of identification badges may be salvaged as many as five times, it is stated, by using a recently developed badge-opening device when replacing



employee photographs. The opener consists of a chuck and a wedge-shaped tool. The badge is held stationary in the chuck by a lever. The tool, mounted on a bracket, attached to a roller bearing, rotates around the badge, and is forced between the two parts of the badge by pressing on the hand lever.

The opener can be adjusted by a thumb screw for slight differences in the badge. The badge is released by lifting the holding lever, and is ejected, wh unsealed, by a small lever at the chuck base.—*Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.*

• • •

Steam-Cost Calculator

Steam costs may be quickly determine with a simple calculator, recently devise for plant engineers and superintendent

according to the manufacturer's an nouncement. These calculators are avail able, without cost, to men in these posi tions who write on their business letter heads.—*Cleaver-Brooks Co., 5100 North 33rd St., Milwaukee 9, Wis.*

• • •

Floor-Patching Material

Developed to fill cracks and other im perfections in concrete or cement floors, a new material, Emeri-crete, is said to hav great adhesive properties and perma nence. This ready-mixed substance, o small particles of pure emery used with a quick-setting binder, permits use of th floor six or seven hours after repairs hav been made. The patches will not shrink it is claimed.

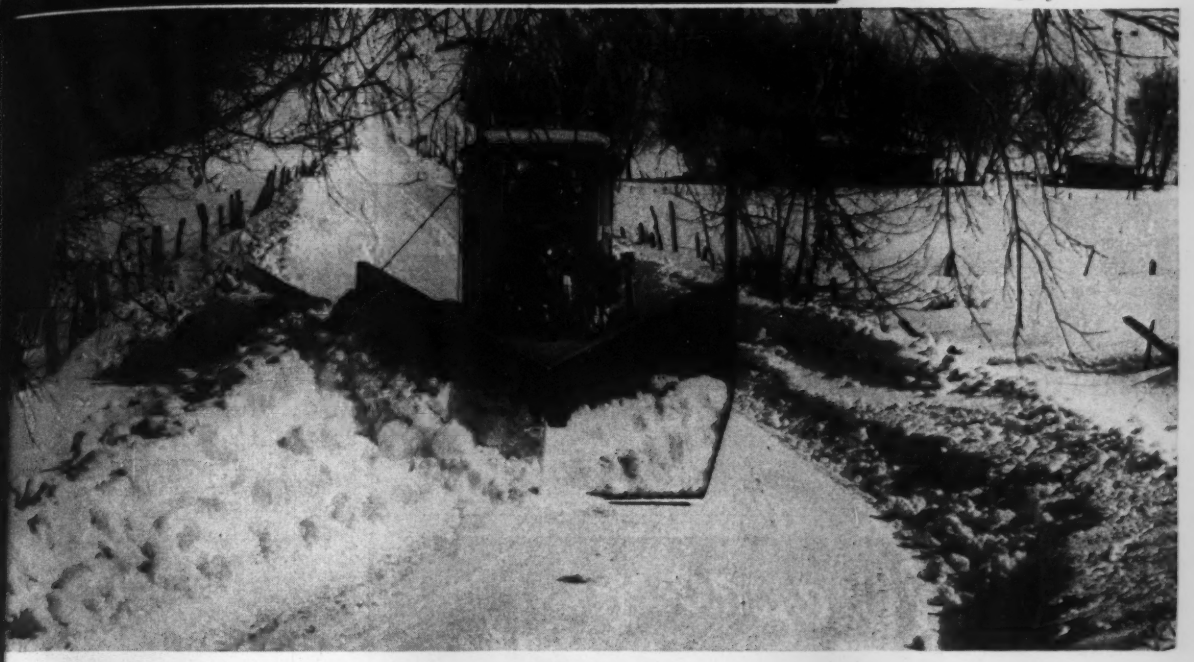
Emeri-crete is packed in small, eco nomical packages; full instructions fo its use are provided.—*Walter Maguire Co., Inc., 330 West 42nd St., New York 8, N. Y.*

• • •

Barometer and Altimeter

Because of the high sensitivity and pre cision in a recently developed barometer and altimeter, these instruments are ideally suited for use in meteorology, sur veying, airport service, research work and as a standard for calibrating othe

EASY STARTING



Tips FOR SUCCESSFUL COLD WEATHER OPERATION

- ✓ **Always** hold clutch pedal down while starting engine.
- ✓ Use good grade of winter gasoline for starting and allow adequate time for motor warm up.
- ✓ Keep spark plugs cleaned and properly spaced.
- ✓ Use correct grades of winter lubricants—not only in engine but in power control box and other gear cases.
- ✓ Use only approved anti-freeze solutions.
- ✓ When filling radiator in freezing weather cover entire radiator, start engine and then put in water **immediately.**
- ✓ Fill fuel oil and gasoline tanks at end of each day's run to prevent moisture from collecting in tanks.

REMEMBER—An Engine in Good Condition is an Easy-Starting Engine

***JUST AS A QUICK PUSH with his ski-poles gets a ski trooper easily into motion, so does the pressing of the starter button cause the engine of an Adams Motor Grader to roar into action in any climate or weather! An Adams Diesel combines the *easy starting* of gasoline with the economy and efficiency of full Diesel operation in a single engine... This feature saves time, trouble and tempers in cold weather operation while its simplicity and easy maintenance make it equally valuable in other seasons . . . After Victory *easy starting* is but one of many Adams features you will appreciate in carrying on your peace-time jobs!

J. D. ADAMS COMPANY, INDIANAPOLIS, INDIANA

Adams motor graders, leaning wheel graders, elevating graders, hauling scrapers, tamping rollers, bulldozers and road maintainers are used by allied forces throughout the world.

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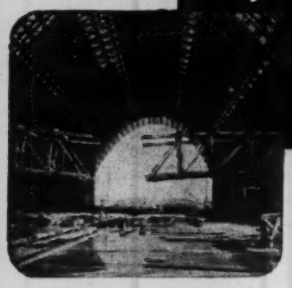

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instruments. These devices have a sensi tivity of one part in 8,000, and an ac curacy of ± 0.1 percent.

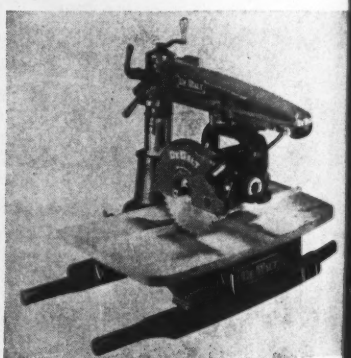
The barometer is furnished with 0.5 millibar graduations over a range of 75 to 1,065 millibars; the altimeter ha

either a 7,000 or a 15,000-ft. range, wit 10 and 20-ft. graduations respectively Other scales can be supplied to meet spe cial needs. Unique simplicity of desig the manufacturer states, helps the instru ments hold their accuracy under sever usage. They are available in shockproo cases for portable service, or for wall o panel mounting.—*Wallace & Tierna Products, Inc., Belleville, N. J.*

• • •

Portable Radial Power Saw

Savings in time and manpower resul from the use of a new portable radia power saw, the manufacturer state Easily carried by two men, the saw wi cross-cut material 14 in. wide by 1 in 12 in. x 3 in. with 12-in. saw, and ri



from 0 in. to 26 in. wide, as well as mite bevel cut off, double miter and bevel ri It is available in 1½, 2 and 3-hp. size with a protected direct-drive motor, i sulated with Formex Fiberglas.

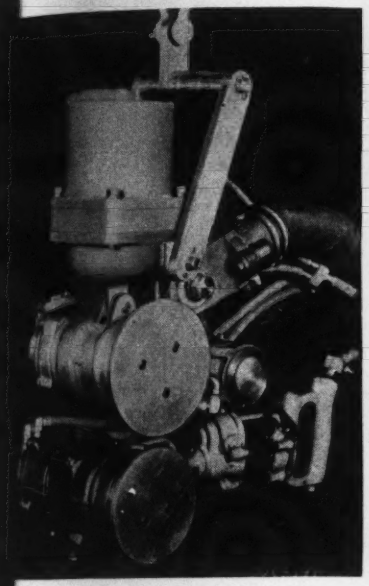
The unit has three simple radial a justments: The sturdy cantilever ar

oves vertically and swings horizontally; he yoke rolls along the arm and rotates orizontally; the motor tilts at any angle. s the weight of the motor is always in ne with the centerline of yoke, arm and olumn, the machine is perfectly bal-nced.—*DeWalt Products Corp., 1000 ountain Ave., Lancaster, Pa.*

• • •

Seam-Welding Gun

Large assemblies mounted in station-ry fixtures, and parts too big to take to he machine, can be readily seam-welded ith a new portable seam-welding gun, he manufacturer announces. The ma-hine, designed for welding steel up to



wo thicknesses of 20-gage, including tainless steel, has already been used to eld 22-ft.-long seams on gas tanks.

The gun permits vertical or horizontal elding. When it is in operation, the air unning into the handle runs the motor. he air cylinder, of 4½-in. diameter, ill give a maximum pressure of 1,400 . per sq. in., with 90 lb. of line pressure. mple water-cooling facilities have been rovided. The gun has a throat depth of in.; its stroke is ½ in. when the wheels re new, and 2 in. maximum when they re worn.—*Progressive Welder Co., 3050 ast Outer Drive, Detroit 12, Mich.*

• • •

Flame Failure Safeguard

First to operate from direct observa-ion of the flame itself, the "Fireye" hotoelectric system of instantaneous ut-off at flame failure applies to oil, gas r pulverized coal pressure-fed burners, he manufacturer claims. Its immediate ction eliminates explosion hazard.

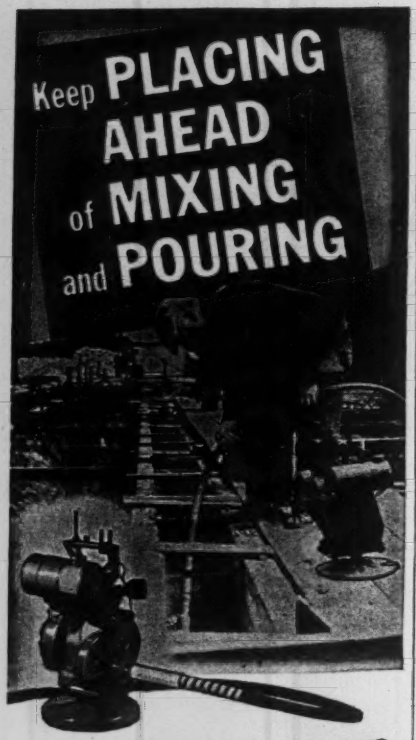
This flame-failure safeguard system, ype F28C, may be used with manually

Whenever you face a

IF you buy equipment that licks the *tough* jobs, you never need worry about the easy ones. In pumps, that means CARVER—the pump designed, built and performance-proved for the really tough pumping jobs. Sizes run from 3,000 to 125,000 GPH. See your distributor for details—NOW!

Model A-25212 (10,000 GPH) on a tough airport dewatering job.

THE CARVER PUMP CO.
Muscatine, Iowa



with a Mall VIBRATOR

Get Stronger Concrete Faster

MALL Vibrators set the pace for mixing and pouring and keep War construction jobs moving on schedule. In addition, they place low-water-cement-ratio concrete faster, better and cheaper than can be accomplished by any other method . . . eliminating honeycombs and voids . . . assuring a better bond with reinforcement . . . and permitting an earlier stripping of forms.

MALL Gasoline - Powered Vibrators, illustrated above, operate all day on very little fuel . . . are easy to start . . . and the variable speed engine supplies abundant power for 8 other quickly interchangeable tools for Wet Wall Rubbing, Sanding, Wire Brushing, Drilling, Sawing, Pumping and Sharpening Tools.

Plan NOW to save time, labor, power, and materials on YOUR next VICTORY job with MALL Gasoline-Powered Vibrators. Write at once for complete information and prices.

Buy War Bonds

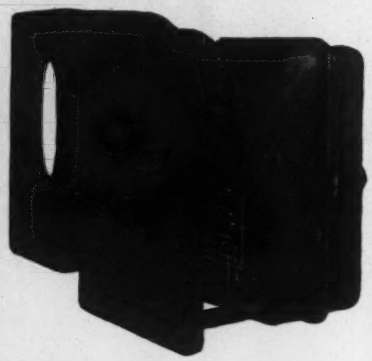
★ ★ *Immediate delivery on Gasoline-Powered 1½ H.P. and wheel barrow or round base mounted 3 H.P. units on suitable priority.*

MALL TOOL COMPANY

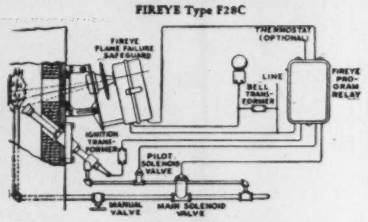
7730 SOUTH CHICAGO AVE.

CHICAGO 19 ILLINOIS

ignited burners to cut off fuel and sound an alarm, or with an automatically fired burner, using program relay Type R-25. The system operates at relatively high



FIREYE Type F28C



Typical FIREYE Installation For Automatically Ignited Oil Burner

ambient temperatures, is mounted directly on the furnace wall, and watches the flame through a window in the wall of the fire chamber. When the electric eye sees flame, the system feeds fuel to the burner; should the flame fail, the fuel supply is cut off.—*Combustion Control Corp., 77 Broadway, Cambridge 42, Mass.*

• • •

Small Wire-Drawing Cored Dies

War has given impetus to the drawing of fine steel wires for cables, etc., and to meet this need, round-hole cored dies, in stock sizes as small as 0.004 to 0.007 in., have been developed. These new dies, it is claimed, eliminate the necessity for a high initial die investment, or of piercing blank dies at the mill. They are available with standard size R-2 Carboloy nibs, and in casing sizes either 1x⅝ in. or 1½x⅝ in.—*Carboloy Co., Inc., Detroit, Mich.*

• • •

Silver Babbitt

A direct outgrowth of the tin shortage is the development of silver babbitt, said to be comparable to tin-base babbitts. Silver, alloyed with a properly balanced lead-base babbitt, has been found to be bondable and corrosion-resistant, and to retain its hardness at operating temperatures without squeezing out.—*National Bearing Metals Corp., St. Louis, Mo.*, with the authorization of the *Battelle Institute.*

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For Sales, Rentals and Service on BLUE BRUTE Portable Compressors, Rock Drills and Air Tools.

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Get more WORTH from air with WORTHINGTON

Buy Blue Brutes

Worthington Pump and Machinery Corp.

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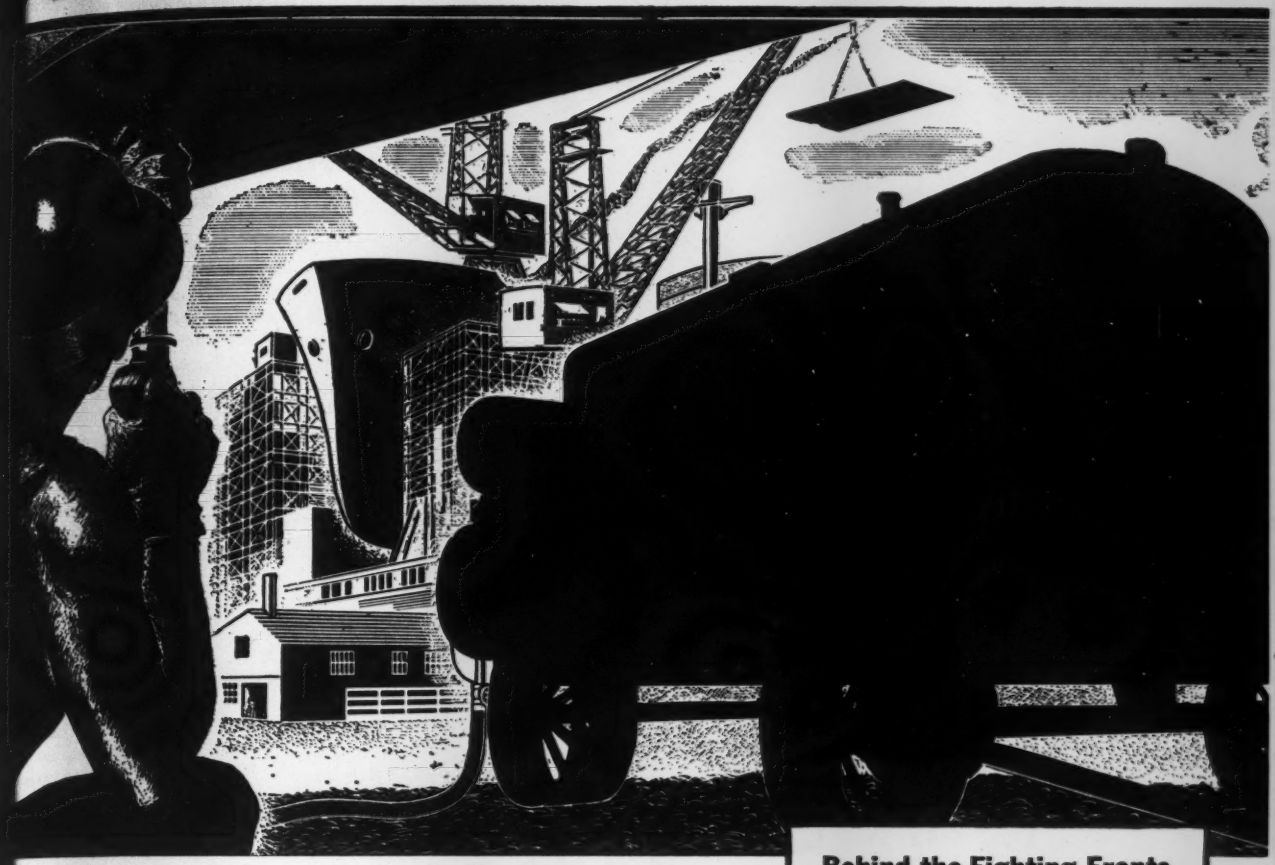

news behind the biggest invasion rchant fleets in world history is our record-breaking 40-day average e from keel-laying to delivery of Ships.

o the yards where this production is being made. The chances are, find rugged Worthington Blue providing trouble-free round-the-ompressed air. But test for your-ese easy-breathing compressors, 315-foot gas-powered Worthington Blue Brute shown above. Dig into the facts. You'll find this secret in Blue Brutes' performance; Feather Valves* insure simplest "throat" action, no destructive impact.

Results show more air delivered by Worthington Blue Brute compressors . . . portable or semi-portable . . . gasoline, Diesel or electric driven . . . and less air needed with Worthington Rock Drills and Air Tools. Your nearest Blue Brute distributor is listed on page 122.

S. Pat. Off. ‡Blue Brute Compressors and Air Tools are painted olive drab for the Army and gray for the Navy until Victory.

Behind the Fighting Fronts with

BLUE BRUTES

A prominent West Coast shipbuilder who breaks records by new assembly methods plus common sense buying policies, uses Blue Brutes to provide air for 24-hour-a-day production.

From beginning to end of this war's global supply lines, Blue Brutes are at work today — often in "uniforms" of olive drab and battleship gray‡ — in hundreds of Army Camps, Navy Yards, Air Bases and Ordnance Plants.

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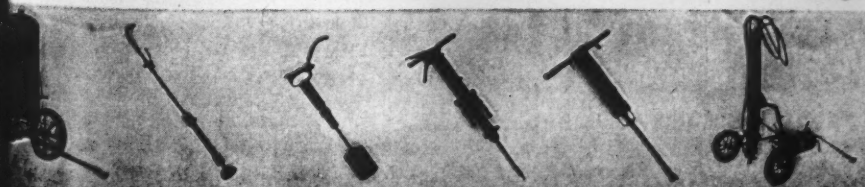
BUY BLUE BRUTES



from 60 to 500 cu. ft. capacity in mount- ill jobs. Rock Drills and Air Tools that have always set the pace for easy operation. Available in a wide range of weights and sizes.

WORTHINGTON

Worthington Pump and Machinery Corporation, Harrison, N. J. Holyoke Compressor and Air Tool Department, Holyoke, Massachusetts

Write for the BUDA jack pocket manual.

BUDA

THE BUDA COMPANY, HARVEY (Chicago Suburb) ILL.

NEWS OF THE WEEK

(*Continued from page 73*)

Mexican construction work continues despite war

During the past year 1,240 miles of highways have been surfaced or paved at a cost of $727,368; and $2,800,000 was spent in repairing and improving federal highways. Preference was given to the road between Mexico City and Suchiato, the second link in the Pan-American Highway. About $4,257,200 has been spent on railroad construction, especially on Ferrocarril del Sureste. The United States government sent a special mission to study Mexican railway problems and with the Mexican authorities have spent $3,089,301 in equipment and improvements.

A great deal of building is going on in Mexico City. Hundreds of tenements are being wrecked, streets widened, and the houses rebuilt. There are dozens of big steel and concrete structures going up, and there are several big real estate developments reminiscent of Los Angeles in 1927. Many apartments are being built to alleviate the acute housing shortage, which may help tourists since there are only 5,000 hotel rooms available.

Hermandez Aldero, chief of the building permit department, says that so far this year 2,984 permits for construction were granted. Of these, 198 were for offices and business houses, the rest for private homes.

The Mexican government reports that it has spent $1,461,880 for work for the navy department during the past year. Most was spent at the Tumbuco, Coatzacoalcos and Icacos dockyards for various repairs.

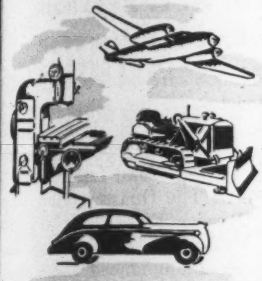
Mexico is embarking on a very large water supply program for 1944. So far, $1,294,000 has been earmarked for distribution to 18 states. The cost will be divided three ways—among the republic of Mexico, the states involved, and the Inter-American office of health, which for several months has been working with Mexican officials. Most of the funds will be spent for new systems, but some will go for repairs and purification of present systems. The sum of $165,000 will be spent in the State of Sonora, of which $100,000 will go to the city of Nogales for a new water system.

Gen. Abelardo L. Rodriguez, ex-president of Mexico and now governor of Sonora State, has ordered engineers to

TRAINING LESSON No. 5
For New 'Dozer Operators

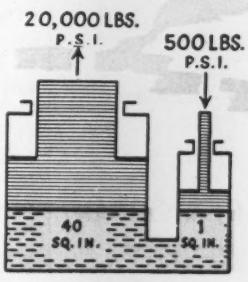
What is this thing called "Hydraulics"?

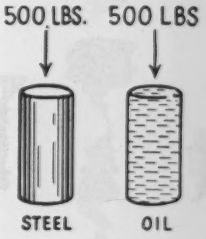
IN 1926, LaPlant-Choate engineers introduced the first bulldozer using hydraulic power to raise and lower the blade. Since that time — the hydraulic method has gained favor over mechanical means in many types of equipment —wherever smooth, efficient application of power is essential. Today you wouldn't buy an automobile without hydraulic brakes. Similarly, the modern trend is to fluid drives . . . hydraulically controlled machine tools . . . hydraulic steering and lifting mechanisms . . . and literally thousands of other recent applications, including vital landing gear mechanisms for bombing planes.



The Hydraulic Principle

THE BASIC principle of hydraulic transmission of power was evolved in 1658 A.D. by a French scientist named Pascal. Pascal discovered that a closed system of fluids *acts like a lever* in transmitting power — and that by applying a relatively small force to a *small* plunger at one end of the system, tremendously increased force will be exerted on a *larger* plunger at the other end. Explained in terms of a modern dozer, Pascal's theorem means simply this: If you have a pump (small plunger) forcing liquid into the hydraulic system under pressure of *500 lbs.* per square inch — plus a pair of two-way jacks (larger plunger) with a combined area of 40 square inches — the total thrust at the end of the jacks will be *20,000 lbs. per square inch.* Moreover, all the operator needs to do is to move a simple control valve and *Presto!* . . . all this surging power is directed instantly and smoothly into the dozer blade — forcing it down, holding it rigid, or raising it, as the job demands.





Oil As A Medium

IN practically all modern hydraulic equipment—including LaPlant-Choate dozers and scrapers — oil is used as the medium of power for a number of reasons. Besides providing excellent lubricating and sealing qualities, oil doesn't rust vital parts, doesn't freeze or evaporate. In addition, oil actually is as incompressible as steel. Did you know, for example, that a column of oil enclosed in a tight cylinder will withstand as much pressure as a solid steel cylinder of equal diameter? That's why oil under pressure has such tremendous strength and leverage — positive power which can be applied instantly in any direction.

Selecting The Right Oil

LIKE any piece of fine precision machinery, a hydraulic system requires *good, clean oil* of the proper type and grade to insure maximum efficiency and long life. In LaPlant-Choate hydraulic dozers and scrapers, tests indicate that best results are obtained with a straight, refined mineral oil, free of compounds and having good stability against oxidation. Correct viscosity, demulsibility and low pour point also are important. The oil tank should always be kept filled to proper level, and should be drained, flushed and refilled with new oil every 550 hours. Always use clean containers and funnels to keep dirt and grit out of the system.

SEE YOUR LaPlant-Choate-"Caterpillar" DISTRIBUTOR FOR GENUINE PARTS AND EXPERIENCED SERVICE

ARMY E NAVY

LaPLANT-CHOATE
MANUFACTURING CO. Inc.
CEDAR RAPIDS, IOWA
'DOZERS, SCRAPERS, RIPPERS, TAMPING ROLLERS
FOR LOW COST EARTHMOVING, LAND CLEARING, SNOW REMOVAL

QUIET
from the start!
Fuller gears are not noisy during the "breaking in" period because the "wearing in" is done at the Fuller factory, where the gears are precision cut, carefully mated and lapped. That's why, when you buy a new truck equipped with a Fuller Transmission, you are not made conscious of the fact that the gears are new. The next thing most drivers notice is the ease with which they can shift through all speeds, forward or reverse. The mechanic likes Fuller Transmissions, too, because they demand a minimum of servicing . . . give the maximum in hours of work before an over-haul or new parts are required. Look for the *quiet* Fuller Transmission when you buy a new truck.
Fuller
TRANSMISSIONS

FULLER MANUFACTURING COMPANY, KALAMAZOO, MICHIGAN
Transmission Division
Unit Drop Forge Division, Milwaukee, Wisconsin

"BLUEPRINT NOW" **and if your plans permit, include**

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WATER METERS

FOR YOUR MASTER WATER RECORDS

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plan and budget a large irrigation dam at Alamito, on the Sonora River. The project will aid 165,000 acres in Hermosillo municipality. Governor Rodriguez plans an agricultural colony on the irrigated lands.

Labor costs for contractors throughout Mexico are increased by the general raise in pay ordered by President Manuel Avila Camacho, effective Oct. 1, for all who receive up to $2.10 a day. The new wages are frozen for the duration of the war. The increase is scaled from 50 percent for those who earn 21c. or less a day to 5 percent for those earning $2.10 daily. Practically all labor on construction and engineering works in Mexico has been earning between 65 and 80c. a day.

• • •

General H. L. Peckham, fuel-lubricant director

Brig. Gen. Howard L. Peckham, formerly instructor in the Department of Engineering at the U. S. Military Academy at West Point, has been appointed director of the Fuels and Lubricants Division, office of The Quartermaster General, Army Service Forces. He succeeds Brig. Gen. William E. R. Covell who has been given an unannounced assignment.

Born at Norwich, Conn., General Peckham was graduated from West Point in 1918, and commissioned second lieutenant in the Corps of Engineers in which he served till promotion to brigadier general in August of last year. His teaching at the Military Academy embraced four years, beginning in 1926. His field duties have included nearly two years of service in Puerto Rico in conection with river and harbor improvements, construction of roads and bridges, and reclamation of swamps.

General Peckham begins his Washington assignment after three years with the Armored Command, being most recently in the Tennessee maneuver area. He had been successively commander of the 17th Engineer Battalion (Armored), and engineer officer of the Second Armored Division, and assistant chief of staff, G-3, of that division; also chief of staff of the Eighth Armored Division, and combat commander of the 12th Armored Division.

• • •

Connecticut River projects again being considered

The House Rivers and Harbors Committee at Washington is again considering a project calling for deepening the Connecticut River between Hartford, Conn., and Springfield, Mass., and developing hydro-electric power at a dam

CONCRETE EXAMPLE

OF 100% WATERTIGHT RESULTS OF ANTI-HYDRO GAUGED CONCRETE

NEW JERSEY ZINC COMPANY

Architect: H. J. Hardenburgh.

Contractor: W. L. Crow Construction Co.

This building rests on the old river bed of New York Harbor. Elevator pit, 18 feet below curb, integrally waterproofed with Anti-Hydro 25 years ago.

WILLIAM L. CROW CONSTRUCTION CO.
Established 1840
101 PARK AVENUE
NEW YORK
TELEPHONE ASHLAND 4-5058

"THE EVIDENCE" A LETTER THAT SPEAKS FOR ITSELF

November 4, 1943.

Anti-Hydro Waterproofing Co.,
299 Broadway,
New York City.

Gentlemen:

A recent inspection of the concrete in the elevator pit of the New Jersey Zinc Company building, corner of Front Street and Maiden Lane, indicates that this installation has remained watertight for a period of twenty-five years. This building rests upon what was the old river bed of New York Harbor.

We installed an elevator pit about 18 ft. below the curbing. In pouring the walls of this pit we mixed Anti-Hydro Waterproofing in the concrete and we have never seen any sign of a leak whatsoever in this pit although in times of high tide there was a height of water at least 15 ft. over the bottom of this pit. We think this speaks very highly of your material and are most glad to let you know what satisfactory results we have obtained.

Very truly yours,

WILLIAM L. CROW CONSTRUCTION CO.

H. W. Lamey
Acting President

CONDITIONS CONCRETE As Alloy Conditions Steel

Increases DENSITY. Increases hydration and dispersion of Portland cement. Increases adhesion to steel. Reduces shrinkage and voids in concrete. Cures internally and eliminates need for surface curing.

Increases HARDNESS. Permits opening concrete to traffic or other use in 24 hours. Produces wear-resistant and dustless surface.

Increases STRENGTH. Reduces water-cement ratio for specified slump (see U. S. Engineers Test). Increases early and ultimate strength with regular Portland cement (see tests of independent laboratories).

Increases DURABILITY. 100% impermeable concrete (Government and independent tests). Weatherproof concrete (see freeze and thaw tests). Prevents penetration of fuel oil, water and moisture. Reduces volume change (autoclave tests).

GUARANTEED RESULTS

A 5-year maintenance Guarantee for waterproof concrete and hard, dustless floors, based on 39 years of performance, can be furnished on Anti-Hydro gauged concrete, installed under manufacturer's supervision.

"ANTI-HYDRO" FOR PERMANENT CONCRETE
HARDENS WATERPROOFS

Send This Coupon For A.I.A. Folder

ANTI-HYDRO WATERPROOFING CO.
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Phone: Bigelow 3-5440

ANTI-HYDRO of CANADA, Ltd.
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NATIONALLY DISTRIBUTED by building supply dealers in all principal cities of the United States and Canada.

Anti-Hydro Waterproofing Co.
265 Badger Ave., Dept. V., Newark 8, N. J.
Please send me A. I. A. folder on Anti-Hydro.

Name_____
Firm Name_____
Address_____
City_____ State_____

IF YOU CHISEL POINT YOUR PENCILS

SEND THIS COUPON TO

EBERHARD FABER PENCIL CO.
37 Greenpoint Ave., Brooklyn, 22, N.Y.

Please send me, for free testing purposes, a MICROTOMIC "VAN DYKE" PENCIL with CHISEL POINT LEAD in_____degree (choice of 2H—4H—6H—HB—2B or 4B).

Name_____

Position_____

Business address_____

20%
MORE LINE PRODUCTION BETWEEN SHARPENINGS

In addition to round leads, MICROTOMIC "VAN DYKE" Drawing Pencils are made with flat, rectangular-shaped leads for quicker and easier chisel pointing.

"CHISEL POINT LEADS" are ⅓ greater in their long dimension than the round lead of the same degree. When sharpened there is 20% more lead at the point of wear. Lines of unvarying width are produced 20% longer. Time out for repointing is 20% less frequent . . . And HI-DENSITY MICROTOMIC Leads have the advantage of always producing more opaque lines and sharper, clearer blueprints.

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VAN DYKE
Drawing Pencils

THE EBERHARD FABER DRAWING PENCIL WITH THE HI-DENSITY MICROTOMIC LEAD

to be built as part of the undertak
The cost to the federal government w
be $12,000,000.

The project is essentially the same
that has been before the committe
intervals for several years. Brig.
John J. Kingman of the U. S. Army E
neers has recommended that the gov
ment pay the cost of raising rail
bridges at Hartford and at Wareh
Point, also the cost of a draw span at
latter place. This would raise the
from $12,344,000 to $12,666,000. L
interests would be asked to ass
$683,000 of the total cost.

. . .

Second tunnel proposed for Oakland inner harb

The Board of Supervisors of Alam
County, Calif., has agreed to call a
cial bond election to raise 25 percen
the cost of a second tube under the e
ary between Alameda and Oakland,
total cost would be $6,500,000.

Current plans are based on the assu
tion that the federal government will
75 percent of the cost, or $4,875,000,
project being put forward as an ac
road to war industries, for which
federal government will put up th
fourths of the cost if certified as a
time necessity by the Army or Navy.
far, the Navy has refused approval
cause of the cost, the long construc
period that would be required, and
current labor shortage.

Efforts to start construction of a sec
tube under the estuary were begun
1941, and between $30,000 and $40
was spent on a survey to determine
need and the approximate cost. Fed
funds were advanced for plans, speci
tions and estimates, which are now c
plete. Hence the present status is
of a ready-to-go postwar project.

The new tube is similar to the exis
Posey Tube and is to be built paralle
it and about 300 ft. to the northw
The tube would be made up of reinfo
concrete cylinders about 200 ft. l
cast on shore, floated to place and su
Estimated construction period is 30
36 months.

The original tube was completed
1928. It was named for George A. Po
Alameda County engineer, who
largely responsible for its construction

. . .

Building appeals board setup in Bay State

Gov. Saltonstall of Massachusetts
named the membership of the ne
created State Board of Standards
Appeals in the Department of Pu
Safety to pass upon regulations for

...HERE ARE THE FACTS—

WILL YOU HELP?

Again a shortage of scrap threatens to curtail production of steel for war. Again the fullest cooperation of all industry is needed to avert the serious consequences. Will you help!

There are several contributing factors to the threatened scrap crisis:

Inclement weather may bring the ore shipping season to an early and abrupt end, necessitating the use of additional scrap in the open hearth furnaces.

A severe winter may handicap the normal collection and movement of scrap.

A shortage of coal may cripple the production of iron in blast furnaces, and require the use of a greater proportion of scrap in making steel.

A breakdown in transportation may likewise force the use of more scrap to hold steel production at the peak level.

Frankly, there is a great possibility that one or all of these factors may suddenly cut our output of steel —unless we get in the scrap now.

Steel mills must have 15,000,000 tons of scrap to carry them through the winter at capacity output.

You can do your part. Revitalize your scrap committee and see that it immediately starts all scrap on its way to the steel mills. Clear out all your scrap *now*, and keep it coming —every ton counts.

At this critical point in the war *we must not falter.*

INLAND STEEL COMPANY

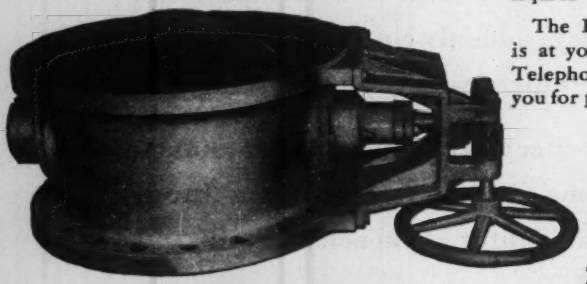
CHICAGO

R-S Valve Engineering Service is NATION-WIDE

In strategically located cities from Boston to Dallas, and from New York to San Francisco, there are thoroughly experienced R-S Valve engineers who are eager to assist in the simplification of valve installations, willing to recommend the type of equipment best adapted to a particular control or shut-off condition and cooperative in pointing out possible changes in present equipment that will effect greater efficiency and economy.

Carefully selected for their engineering ability and experience in the installation and operation of valves, these men have been especially trained in the selection of alternate metals for resistance against heat, abrasion and corrosion as well as the application of R-S Valves under high or low pressures and temperatures whether the medium to be controlled is air, gas, steam, liquids or semi-solids.

The R-S representative is at your beck and call. Telephone the one nearest you for prompt service.



No. 502

20-inch, 125 pound American Standard Valve, hand wheel control, ball bearing mounted with stuffing box.

15 to 900 psi

Atlanta, Ga.
C. E. JOHNSON & ASSOCIATE, Bona Allen Bldg., Walnut 4571

Baltimore, Md.
KONE ENGINEERING CO., 11 W. 25th St., Belmont 0138

Boston, Mass.
W. B. PARSONS CO., 10 High St., HUBrd 4119

Buffalo, N. Y.
R. W. CRANE, 37 Parkwood, Kenmore, N. Y., DELawr 8141

Charlotte, N. C.
LYDON-COUSART COMPANY, 304 Builders Bldg., Phone 3-4481

Chicago, Ill.
W. P. NEVINS CO., 53 W. Jackson Blvd., Harrison 1473

Cincinnati, Ohio
H. T. PORTER CO., 1413 Union Central Bldg., Main 1299

Cleveland, Ohio
ASHMEAD-DANKS CO., Rockefeller Bldg., Main 6192

Des Moines, Iowa
PRODUCTS, INC., 1006 Liberty Bldg., 4-0777

Detroit, Mich.
SPURGEON COMPANY, 5050 Joy Road, Tyler 7-2750

Houston, Texas
POWER SPECIALTY CO., 1042 Mellie Esperson Bldg., Preston 5384

Indianapolis, Ind.
POWER PLANT EFFICIENCY CO.
Union Title Bldg., Market 4617

Los Angeles, Calif.
BUSHNELL CONTROLS & EQUIPMENT CO.
117 W. 9th St., Vandike 1359

Milwaukee, Wis.
KRENZ & COMPANY, 5114 W. Center St., Hilltop 2983

Minneapolis, Minn.
GEO. R. MELLEMA, 4234 Grimes Ave. So., Walnut 6984

New Orleans, La.
JOHN H. CARTER CO., 1013 Canal Bldg., Magnolia 1847

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F. H. YOCUM-A. H. GOODE, Graybar Bldg., Murray Hill 5-3370

Philadelphia, Pa.
SHEFFLER-GROSS CO., Drexel Bldg., Lombard 4900

Pittsburgh, Pa.
J. F. HALLOWELL, Columbia Bldg., Court 5362

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GEO. VAN VECHTEN, 217 East Avenue, Stone 4164

St. Louis, Mo.
RUSSELL PATTON, 3020 Olive St., Franklin 2836

San Francisco, Calif.
BUSHNELL CONTROLS & EQUIPMENT CO.
Mills Tower, 220 Bush St., Exbrook 1102

Seattle, Wash.
M. N. MUSGRAVE & COMPANY, 2019 Third Ave., Eliot 4425

Tulsa, Okla.
DOUGLAS FRAZIER, 1524 So. Gary Place, 6-0384

Washington, D. C.
A. BURKS SUMMERS
411 Colorado Bldg., 14th & "G" Sts., N.W., Republic 7231

VALVE DIVISION
R-S PRODUCTS CORPORATION
116 Berkley Street • Philadelphia 44, Pa.

R-S Streamlined BUTTERFLY VALVES

construction and use of buildings for public assembly. The board was created as a result of the Cocoanut Grove holocaust in Boston. Members are to be paid $20 per day for each day of service, with a maximum of $1,000 per year. Those appointed are: W. R. Greeley, Lexington, architect, chairman; W. E. Dibble, Springfield, associate architect; Thomas Worcester, Waltham, and R. U. Cross, Worcester, registered professional engineers; E. J. Ruxton, Springfield, and James F. Fitzgerald, Boston, contractors; E. A. Johnson, West Roxbury, and Harry P. Hogan, Springfield, building trades unions; L. E. MacBrayne, Belmont, executive vice-president Massachusetts Safety Council; and Lt. Com. E. P. Knight, U. S. N., Boston, associate safety engineer.

• • •

War construction program now nearly complete

Approximately 15,000 separate projects have been built under the war construction program since June, 1940, and of this number more than 90 percent are now in use, according to announcement by the War Department. The total cost, including real estate acquisition and maintenance expense amounted to $11 billion. Though the war facilities program is now practically complete, it is estimated that repair and upkeep during 1943 will cost $400,000,000, and will use services of 100,000 persons.

More than 1,000 facilities, including camps, reception centers, and replacement centers for the Army Service Forces and the Army Ground Forces in the continental United States and the off-shore bases leased from Great Britain, have been constructed at a cost of more than two and one-half billion dollars. Another two and one-half billion went for 1,500 air bases, tactical air fields, schools, and depots and the like; and three billion for the construction of plants for the manufacture and storage of munitions and warfare chemicals, hospitals, harbor defenses, highways, and hundreds of other military installations. The projects under the last figure were started by the Quartermaster Corps and later transferred to supervision under the Corps of Engineers.

Civilian war housing outside of cities cost $36,000,000; and the camouflage program, including protective measures both for this country and abroad, cost $40,000,000.

The program included 16,680 miles of electric lines; 480,000,000 sq.yd. of roads, runways on airfields, and parking spaces; and buildings totaling 1,800,000,000 sq.ft. of floor space.

No figures are available as to the exact amount of emergency construction yet to be done.

S. J. GROVES & SONS COMPANY

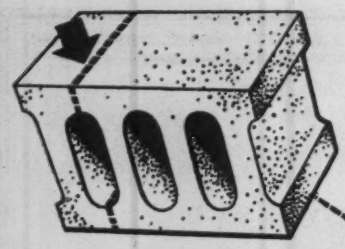
—and—

JOHNSON, DRAKE & PIPER, INC.

Announce

the award of the Army-Navy "E" for outstanding achievement in war construction on their Newark Airport Project.

Newark Army Air Base, October 27, 1943



HAVE YOU EVER CUT CONCRETE BLOCKS with SKILSAW?

● Do you know how many *different* jobs your SKILSAW can do? It can save you time and money on *many* operations besides cutting lumber! For example: use it with ABRASIVE DISCS (illustrated at left) to size concrete blocks and limestone sills . . . to cut slate, tile, brick and Terra Cotta . . . to saw asbestos cement sheets for walls and sidings.

There are so many ways you can use your SKILSAW to get the inside track on bigger, more profitable contracts in the days to come. Ask your distributor to show you how . . . NOW!

SKILSAW, INC., 4771 Winnemac Ave., Chicago, Ill.

New York • Boston • Buffalo • Philadelphia • Cleveland • Detroit • Indianapolis • St. Louis • Kansas City
Atlanta • New Orleans • Dallas • Los Angeles • Oakland • Portland • Seattle • Toronto, Canada

SKILSAW PORTABLE ELECTRIC **TOOLS**

★ MAKE AMERICA'S HANDS MORE PRODUCTIVE ★

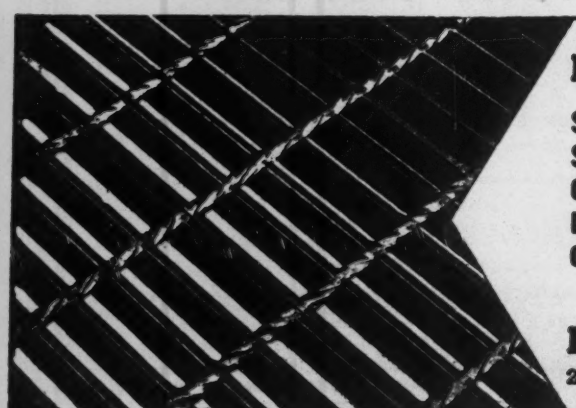
SKILSAW quickly cuts Asbestos Cement sheets with Abrasive Discs

MANUFACTURERS' ACTIVITIES

THE QUIGLEY COMPANY, INC., announces the removal of its general offices to new, enlarged quarters at 527 Fifth Avenue, New York, 17, N. Y. The Quigley Company manufactures industrial specialties.

HUB INDUSTRIES, INC., producers of aircraft hydraulics, Long Island City, N. Y., has established a special development division at Stamford, Conn., to study the postwar applications of hydraulics to other industries, Alec E. Ulmann, president, has announced. The new division will function independently of Hub's Long Island City plants in which hydraulic aircraft equipment is produced for the Allied air forces. Foremost among the studies undertaken by the Stamford plant will be those dealing with the use of hydraulics in the automotive industry. In connection with this, work has already been started on developing equipment for hydraulic power steering, power braking, and the actuation of bus doors and dump bodies.

ANNOUNCEMENT is made by W. C. Carter, president, Link-Belt Co., that the Link-Belt Company has purchased the manufacturing plant and inventory of Link Belt Supply Company in Minneapolis, Minn., and that Ray S. Wood has been appointed plant manager. Link Belt Supply Company has worked with Link-Belt Company since 1900, having served as an authorized distributor of Link-Belt Company products in the Twin



BLAW-KNOX Electroforged STEEL GRATING

SAFE—Twisted bar does the trick
STRONG—One-Piece Electroforged
CLEAN—No sharp angles to clog
EASY TO PAINT—All surfaces accessible
OPEN FOR LIGHT & AIR—Maximum open area

WRITE FOR CATALOG NO. 1887

Blaw-Knox Division of Blaw-Knox Company

2001 FARMERS BANK BUILDING • PITTSBURGH, PA.

HOME... for NAVY ENLISTED PERSONNEL

WALLABOUT HOUSES . . . . . is the name of this new and completely modern apartment house erected for enlisted personnel attached to the Brooklyn Navy Yard. It contains 207 apartment homes . . . . . compact, but comfortable living for Navy men and their families.

Here again Stanley was called upon to supply butts for all the doors.

In the gigantic government construction program which includes the building of living quarters for army, navy and air corps personnel, administration buildings, hospitals, factories, and housing for war workers, huge quantities of hardware are required. Much of it is being supplied by Stanley. In spite of the fact that our line has been simplified, manufacturing efficiency increased, and production stepped-up, it is impossible to supply both government and civilian needs.

We feel certain that you understand why there is a shortage, and realize, that once this war is behind us, you will have all the Stanley Hardware you will need for the building days ahead. The Stanley Works, New Britain, Connecticut.

1843 STANLEY 1943

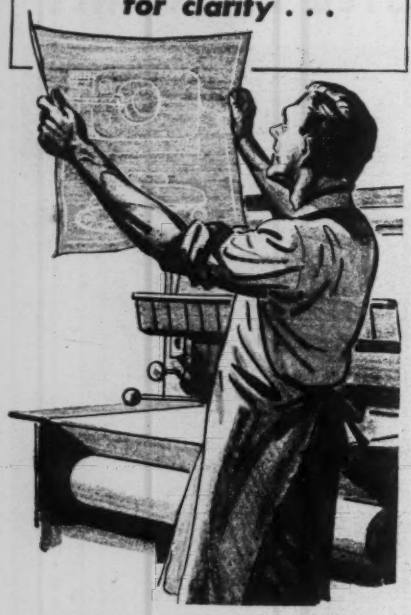
TRADE MARK

WALLABOUT HOUSES was designed by architect Wm. I. Hohauser of New York City. The general contractor was Corbetta Construction Company of New York City . . . . . and the Lockwood Hardware Manufacturing Company handled the hardware contract.

Photo, courtesy National Housing Agency

STANLEY
HARDWARE

The greater the need for clarity . . .



. . . the greater the need for

ARKWRIGHT TRACING CLOTHS!

If you want your drawings to reproduce clearly and sharply no matter how often they're run through the blueprint machine, use Arkwright Cloths. Highly transparent from the first, Arkwright Cloths always remain so . . . never become yellow or opaque with age. Try Arkwright Tracing Cloths yourself. See if they don't give you better transfer, sharper reproduction than any tracing cloth you've ever used. Arkwright Finishing Company, Providence, R. I.

Arkwright

TRACING CLOTHS

AMERICA'S STANDARD FOR OVER 30 YEARS

Cities territory. The entire Minneapolis organization will be retained, present manufacturing facilities will be improved, and stocks are to be expanded as rapidly as possible. Mr. Wood, the new plant manager, started his Link-Belt Company career in 1914, in the engineering department at the company's plant in Philadelphia.

J. HANDLEY WRIGHT, executive vice-president of the Associated Industries of Alabama, has resigned and accepted a position on the general staff of the Monsanto Chemical Company, St. Louis, Mo. He will head the department of industrial and public relations and will have charge of the advertising, and administer the public and industrial policy of the company. He will assume his new duties December 1. He went to Birmingham, Ala., about four years ago from New York where he was associated with the National Association of Manufacturers, to become executive secretary of the Alabama Association. Mr. Wright is a native of Nashville, Tenn., and a graduate of Vanderbilt University.

JOHN B. ROSS, formerly with Linde Air Products Co., has been appointed to the West Coast engineering office of Handy & Harman. Mr. Ross will serve West Coast industries and shipyards in the capacity of brazing engineer in the application of Handy & Harman's silver brazing alloys and other precious metal products. Mr. Ross is a graduate of the University of California, where he was employed for some time on advisory work. Following this, he went with a large Western oil company and finally became associated with the gas consuming apparatus field, which he has served since 1925. In his new appointment, Mr. Ross will make his headquarters at the Los Angeles office of Handy & Harman which serves California, Washington and Oregon.

WALLACE K. BROWN, former vice-president in charge of procurements for the Crocker-Wheeler Electric Mfg. Co., has been made manager of the New York district sales of the Crocker-Wheeler Division of the Joshua Hendy Iron Works office there. Mr. Brown first went with the Crocker-Wheeler Electric Mfg. Co. in 1908 as an apprentice engineer, after completing his technical training at Clarkson College of Technology and the University of Illinois. He has been district manager in San Francisco, Calif.,

To water or dewater land

and for all water needs

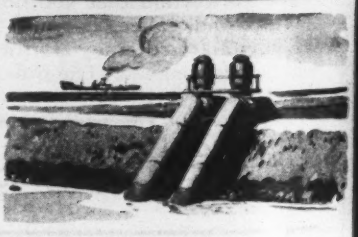
PEERLESS PUMPS

are the water way to Victory

10 TO 200,000 GALLONS PER MINUTE

Peerless builds pumps for every conceivable water-lifting purpose. Whether you want ten gallons per minute, or several thousand, whether you want to lift water one foot or several hundred, Peerless has a pump that will just fit the condition. This is made possible by a full range of sizes and capacities, plus a choice of any type of drive.

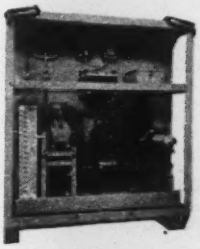
PEERLESS PUMP DIVISION
Food Machinery Corporation
301 W. Avenue 26 • Los Angeles 31, Calif.
FACTORIES:
Los Angeles, San Jose, Fresno, Calif.; Canton, Ohio



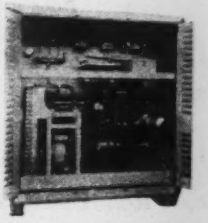
The Weber Portable Lift Refrigerator

A TRULY portable refrigerator, capable of uninterrupted operation in any climatic condition from sub-zero to sweltering hot. It will perform continuously on either gasoline or electric power, A.C. or D.C., while en route by water, rail or truck. No refrigeration expert is needed to put it in action, *anytime, anywhere*. It's easy to operate and will maintain either low or standard refrigeration temperatures with a 100° outside temperature differential. This was Weber's answer to a particular need... a particular problem in design and production. ¶ If you have a special manufacturing problem in metal, wood or glass... anything concerned with war work, Weber facilities and experience are available to help you. Write or wire today.

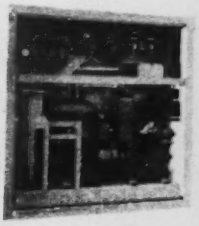
THREE TYPES OF POWER EQUIPMENT TO MEET WORLD-WIDE NEED



Type B, Direct gasoline engine power operated.



Type U, Direct gasoline engine, convertible to A.C. Electric.

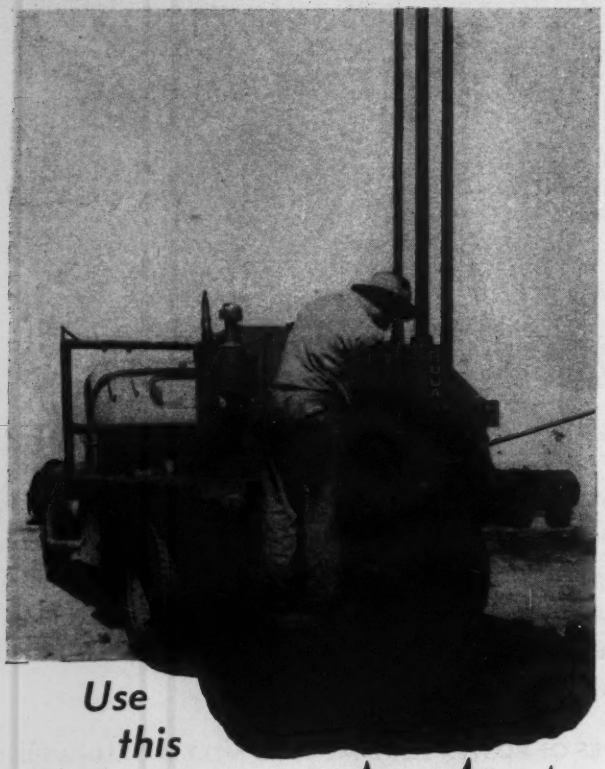


Type H, Gasoline powered electric generator and A.C. or D.C. operation.

WEBER FACILITIES & EXPERIENCE
"WORKING FOR VICTORY"

WEBER SHOWCASE & FIXTURE CO. INC., 5700 AVALON BLVD., LOS ANGELES, CALIF. • EST. 1898

BUDA
EARTH DRILLS



Use this
Modern Method

. . for quickly drilling clean, straight holes for Pole, Pile, Pier, and Fence Posts . . . USE THE

BUDA EARTH DRILL
for all tough drilling jobs

Write or wire for bulletin to

THE BUDA CO. HARVEY (Chicago Suburb) ILLINOIS

and Newark, N. J., and eastern sales manager in New York. Brown is serving on the Subcommittee on Government Questionnaires, War Production Board.

DEAN ROLLANS, vice-president in charge of sales, Wickwire Spencer Steel Company, has announced the appointment of Charles B. Konselman, as advertising manager. Mr. Konselman succeeds George L. Randall, recently commissioned a Lieutenant (j.g.) in the U.S.N.R., and now stationed temporarily at the Naval Air School Quonset Point, R. I. Prior to joining Wickwire Spencer and for the past six years, Mr. Konselman was associated with the Royal Typewriter Company, the last three years as sales promotion manager. Mr. Konselman will be located at the company's home office, 500 Fifth Ave., New York 18, N. Y.

R. P. TYLER has been appointed general manager of sales and C. R. Deam as assistant manager of sales of A. Leschen & Sons Rope Company, St. Louis, Mo.

JESSE H. HARRIS, engineer, has organized the Jesse H. Harris Company at Minneapolis, Minn., to succeed the firm of Rose & Harris. The partnership of Rose & Harris, Engineers was dissolved in September.

THE GRAND ISLAND CULVERT & METAL WORKS, Grand Island, Neb., has been purchased by the Krause Roofing Company of Lincoln, Neb.

THE APPOINTMENT of Joseph B. Terbell as first vice-president of the American Manganese Steel Division of the American Brake Shoe Company has been announced by the company, with which he has been connected for fifteen years. Mr. Terbell was born in 1906 and was graduated from the Sheffield Scientific School of Yale University in 1928. In October of that year he joined the American Manganese Steel Division. After serving an apprenticeship of about two years in the Chicago Heights plant he entered the Chicago sales office and sold both manganese steel and Amsco alloy castings. In 1933 Mr. Terbell moved to St. Louis, Mo., as assistant manager of the alloy department. In

Never before in any war...
motorized equipment that pulls itself up by bootstraps *of modern*

Preformed wire rope

Dragging a heavy field piece through trackless wilderness, the sturdiest "cat" may bog down and stall in deep and slippery mud.

In this emergency the line of Preformed Wire Rope on the front winch is securely anchored to a rock or tree up ahead. Then, with a strong and steady pull, the "cat" inches its way out of trouble and resumes its journey.

Preformed Wire Rope handles these patient, ponderous jobs as well as the hair-trigger reactions of airplane controls—as easily as the thousands of everyday jobs. Preformed Wire Rope wears longer, speeds work, reduces accidents, slashes costs. If you haven't tried Preformed Wire Rope—

Ask your own wire rope manufacturer or supplier

DREDGING

Filling, Land Reclamation, Canals and Port Works

River and Harbor Improvements
Deep Waterways and Ship Channels

We are equipped to execute all kinds of dredging, reclamation and port work anywhere in the United States

Contractors to the Federal Government

Correspondence invited from Corporate and Private Interests Everywhere

Largest Plant **Longest Experience**

Atlantic, Gulf and Pacific Co.

15 Park Row
New York 7

Citizens State Bank Bldg.
Houston 2, Texas

Lubrication ...1943 STYLE

GRACO CONVOY LUBERS Speed THE WHEELS OF VICTORY

The *right grease* in the *right place* at the *right time* is helping to keep both military and construction equipment working harder, longer hours. Graco Convoy Lubers are servicing both military and construction equipment all over the world. Mounted on trucks, Convoy Lubers are able to follow rapidly moving military equipment, or keep up with the bulldozers and scrapers on the job.

Graco Convoy Lubers come equipped with heavy duty pumps which dispense track, gear, chassis, and hypoid lubricants at high speed through 30-ft. reel mounted hoses. A convenient 50-ft. air line services all size tires and can also be used for operating small pneumatic tools.

Increased production of Graco Convoy Lubers has made short time deliveries possible. A letter or wire will bring detailed information about these extremely useful field lubrication units. Ask for catalog No. 129.

GRACO

GRAY COMPANY, INC.
MINNEAPOLIS • MINNESOTA

1935 he went to Chicago in the sales department; and during 1936 was transferred for a brief period to the American Forge Division. He went back to Amsco in 1937, being located in the New York office as eastern sales manager. In 1940 he was appointed a vice-president of the American Manganese Steel Division.

APPOINTMENT of James R. Weaver as manager of the Naval Ordnance Plant at Center Line, near Detroit, Mich., has been announced by F. D. Newbury, vice-president of the Westinghouse Electric & Mfg. Co. Mr. Weaver has been transferred from the Louisville plant where he had been manager since November, 1940. His successor there is C. E. Shiplet, former superintendent. In February of this year, Mr. Weaver was awarded the Westinghouse Order of Merit for speeding vital war materials.

Mr. Shiplet also received the Westinghouse Order of Merit, in September of last year, for his ability in organizing unskilled workers into a trained and enthusiastic team capable of assembling equipment of extreme accuracy of workmanship. Mr. Shiplet was born in 1886 in Woodstock, Va. He attended Iowa State College. He joined Westinghouse in 1907 as a draftsman in the steam engine division. For 15 years he was a designer and engineer with the Farm Machinery Manufacturing Company, returning in 1924 as general foreman of the Mansfield, Ohio, Works.

TO ASSIST American business in foreign trade development, the new importing and exporting company of Herman Yaras has been formed in Los Angeles, Calif. This concern will occupy itself primarily with the development of distribution contacts in the Central and South American countries, as well as the Far East. Mr. Yaras, whose experience has included directing the foreign sales of some of America's largest companies, such as Westinghouse, Sears Roebuck, Republic Steel, Pennzoil, Cleveland Tractor, Eli Lilly, Royal Typewriter

Our troops inspect a captured Axis tank, looking for booby traps.
INTERNATIONAL NEWS PHOTO

Every battle is a showdown . . . our men, weapons and equipment against the enemy's . . . *wire rope* included. That's why our forces need the best rope they can get . . . *and lots of it.* Below are some of the ways in which *you* can help to send more wire rope over there by making your own rope *last longer* over here:

1. Start with the correct wire rope. If uncertain about size, grade or construction for your specific job, ask us or any distributor.

2. Check equipment thoroughly. Repair or replace worn, corrugated or wobbly sheaves. Line up sheaves with each other and with drums, making sure rope does not rub against flanges. Inspect drums for roundness.

3. Install rope carefully. Avoid kinking when unreeling and handling. Never drag rope across concrete or gravel. Wrap rope snugly and evenly on drum, avoiding cross-winding.

4. Break in rope cautiously, gradually increasing speeds and loads. And break in the operator, if inexperienced. Instruct him in the importance of smooth starts and stops . . . reasonable loads . . . frequent examination of rope, sockets, clips and splices.

5. Care for your rope. Clean and lubricate regularly. On many installations rope can be cut off or shifted to distribute wear. Get better acquainted with ropes by sending for our free Industrial Wire Rope Hand Book and Riggers' Hand Book.

One thing more: Use wire rope of known stamina and dependability. *Preformed* Yellow Strand combines flexibility, toughness, elasticity and strength in proper balance. It stays on the job . . . curtails replacements . . . helps you keep manpower and equipment producing . . . for Victory.

Broderick & Bascom Rope Co., St. Louis

Branches: New York, Chicago, Houston, Portland, Seattle
Factories: St. Louis, Seattle, Peoria

YELLOW STRAND
PREFORMED WIRE ROPE

Most big fires start from little fires. If firemen arrive during the first few minutes, a blaze is often extinguished in a jiffy, thus reducing fire losses. If there is delay from any cause, even for a few minutes, what would have been a minor blaze often turns into a disastrous conflagration. That is why it pays to have MUELLER-COLUMBIAN Fire Hydrants. . . When the hoseman jumps off the truck to hook up the hose the nozzle caps come off quickly. There are no tangled cap chains to slow him up. Precise clearances of the chain loop prevent that. MUELLER-COLUMBIAN hydrants open instantly. The ball-joint packing mechanism in the bonnet positively eliminates binding of the stem. The self-oiling top prevents rusting of the stem threads. It also keeps the packing perpetually lubricated so that it never dries out. No water can ever enter the bonnet from the barrel. The all-weather cap keeps water out of the operating stem mechanism. Positive-action drain valves keep the barrel always dry when not in use. Here is a hydrant that cannot stick or freeze. . . All these features assure quick opening in any weather, precious minutes gained, and many dollars saved in fire loss.

In addition to the Improved and Standard line of MUELLER-COLUMBIAN Hydrants we also build Underwriter, Industrial, and Flush-Type models. Write us for complete details.

★ ★ ★ ★

The ONLY place for your extra money is in War Bonds and Stamps. YOU must help win the war.

★

MUELLER CO. ★ ★ ★ ★

CHATTANOOGA 1, TENN.

and others, has recently returned from an extensive trip in Central America.

ROBERT B. MCCOLL, vice-president manufacturing, American Locomotive Company, has been elected a director of the company. He was born in Kilmarnock, Scotland where he attended the local academy and the Science and Art College. After serving a special apprenticeship and working in various departments on the Glasgow & South western he was employed by Robert Stephenson & Sons, locomotive builders, Darlington, England, as draftsman. In 1905 he went to the Montreal Locomotive Works, Ltd., Montreal, Que., and served in several departments until he became assistant superintendent, then superintendent of works and finally works manager. In 1917 he was appointed manager of the munitions department of the Eddystone Munitions Company. Returning to England he was appointed general manager of the Armstrong Witworth Company. In January 1922, he became attached to the New York Office of the American Locomotive Company. In 1936 he was elected president of the Alco Products, Inc., a division of the American Locomotive Company, and later when Alco was merged with the parent company he was appointed vice-president of the American Locomotive Company, Alco Products Division. On March 1, 1940 he was appointed vice-president, manufacturing.

GOULDS PUMPS, INC., Seneca Falls, N. Y., has announced the appointment of Eric E. Backlund as sales manager. Mr. Backlund went with the company in 1923. After two years in the plant, he joined the export department and until 1932 traveled extensively in Central and South America. He was then made manager of Gould's Philadelphia office and served in that capacity until he returned to the headquarters office in 1935 as assistant sales manager, which position he has held until his present appointment.

JAMES K. SUTHERLAND, assistant general superintendent of Youngstown Sheet & Tube Co. plants at Youngstown, Ohio, has left there to assume new duties as assistant general manager of the Great Lakes Steel Co. in Detroit, Mich. Sutherland, with Sheet & Tube 34 years, helped the company to make its first open hearth steel.

UNIVERSAL UNIT POWER SHOVEL CO. of Milwaukee, Wis., has changed its name to the Universal Unit Machinery Corp.

A big 10-ton, Diesel-powered Mack in grim war paint rushes supplies to the front. Sketched from photos, by Peter Helck.

1943 MACK MFG. CORP.

...WAR REPORT... WITH A PEACETIME TWIST?...

For your future reference, we'd like to put two facts on the record now. *Fact One*—there are *more* Mack Diesels in the United Nations' armies than any other make of heavy-duty Diesel truck. *Fact Two*—the only 10-ton Diesel trucks used by United Nations' armies which are made and powered by one manufacturer are Macks. This may surprise you . . . and it may mean a lot some day when *you* are deciding what Diesel to buy.

Mack Trucks, Inc., Empire State Building, New York, N. Y. Factories at Allentown, Pa.; Plainfield, N. J.; New Brunswick, N. J. Factory branches and dealers in all principal cities for service and parts.

Mack

TRUCKS
FOR EVERY PURPOSE
ONE TON TO FORTY-FIVE TONS

BUY U. S. WAR BONDS

IF YOU'VE GOT A MACK, YOU'RE LUCKY...IF YOU PLAN TO GET ONE, YOU'RE WISE!

%PROPORTIONEERS, INC.%

Chemical Feeder Headquarters

WE'VE WORKED

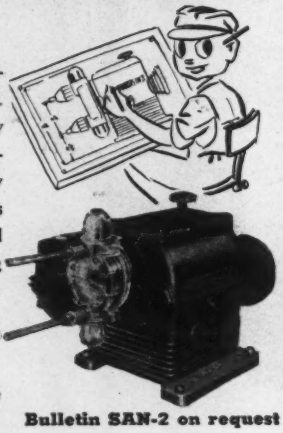
Thousands of boys in America's armed forces in remote and isolated places depend for pure drinking water on %Proportioneers% Pur-O-Pumpers, our portable water purification units. We at %Proportioneers, Inc.% are proud to have had a direct part in helping the war effort by supplying equipment to protect the health of our fighting men.

WE'VE DELIVERED

Now we can again make immediate deliveries from stock of the popular "Little Red Pump", our Heavy Duty Midget Chlor-O-Feeder. To fill wartime needs, we have increased our production and can now make deliveries on a pre-Pearl Harbor basis. Complete manufacturing facilities "under one roof" enable us to assure high quality and prompt deliveries.

WE'VE PLANNED

For the past ten years %Proportioneers, Inc.% has been intimately associated with waterworks engineers and operators. More than a thousand of these men have told us what they want in a chemical feeding unit. Many of their ideas are embodied in the design of the new %Proportioneers% Heavy Duty Chem-O-Feeder, shown at right. Here are two of its principal features: Chemical feeding rate may be selected and changed at will, while unit is operating, by simply turning feed selection knob.--- feeds chemical continuously, thus avoiding "shot" feeding and unevenly distributed solution.



%PROPORTIONEERS, INC.%

92 Codding St., Providence, R. I.

Bulletin SAN-2 on request

EPPINGER & RUSSELL Co., wood preservers since 1878, have recently acquired the wood preserving plant formerly operated by the Norfolk Creosoting Co. at Money Point, Norfolk, Va.

J. J. SOMES has been appointed sales representative for the Irving Subway Grating Co., Long Island City, N. Y., for the Chicago district to replace A. G. McNerney, who has joined the Army. C. C. Banholzer has been appointed to the central Wisconsin territory at Milwaukee to succeed W. H. Reinke who died recently.

FRED W. PENNINGTON, until recently in the publicity department of the Westinghouse Air Brake Co., has been appointed manager of publications and advertising for Kennametal, Inc., at Latrobe, Pa., which succeeds the McKenna Metals Co. The personnel, management, products and policies remain the same.

Self-locking stop nuts are now being produced at the highest rate in history, William T. Hedlund, president of the Elastic Stop Nut Corporation of America, has announced. The company's production for a single month, well in the hundreds of millions of units, is almost double the monthly production six months previous, and triple the rate for the same month a year ago, he said. The announcement was made in conjunction with production awards to employees.

BRANCH OFFICES to serve two further Ohio industrial areas have been announced by S. B. Hellstrom, general manager, Detroit Tap & Tool Co., Detroit, Mich. The company, which produces taps, thread gages, thread milling cutters, and a variety of tapping and checking equipment for threads, will be represented now in Cleveland and Dayton in addition to Toledo. The Dayton office at 710 Harries Building is in charge of H. E. Roedter, while George Pierce will head the Cleveland office staff in the Penton Building.

Tanks move doggedly forward wreaking havoc on the enemy but their speed is necessarily slower than trucks and their span of continuous service considerably more limited.

So they crawl up on Rogers Trailers and are moved quickly to the line of combat—or from it when repairs or reconditioning becomes necessary.

Thus, the effectiveness of an important combat unit is increased manifoldly by these non-combat vehicles.

ROGERS
CONVERTED
HEAVY DUTY
TRAILERS

ROGERS BROTHERS CORP., ALBION, PENNA.

VAST CONSTRUCTION PROGRAM LIES BEHIND THE ARMY'S TRAINING

WHAT price war? The cost of war construction alone runs into billions of dollars. Turning Ameri- civilians by the millions into highly-skilled fighting ces required the construction of huge camps, for train- purposes . . . quickly!

re too as in the construction of airplane factories, nament plants and all other industrial projects of war, high Cement found an essential place. In much of this rk serious delays were eliminated by the use of Lehigh rly Strength Cement, which makes concrete of service ength in ⅓ to ⅕ the time required by normal cement. cite just two examples: concrete in camp roads in use thin 24 hours, and superstructures of buildings started day after concrete for foundations was placed.

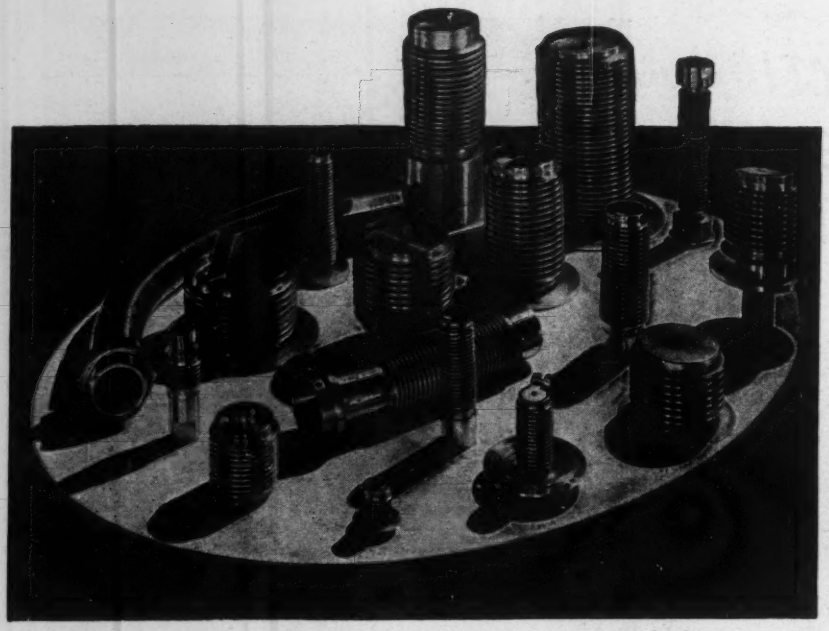
The time-saving advantages of Lehigh Early Strength Cement apply, often at reduced cost, to concrete construction of all types and for all purposes—public and private.

The Lehigh Service Department will gladly answer all questions on uses of Lehigh Cements.

Lehigh CEMENT

LEHIGH EARLY STRENGTH CEMENT for **service-strength** concrete in a **hurry**

EHIGH PORTLAND CEMENT COMPANY • ALLENTOWN, PA. • CHICAGO, ILL. • SPOKANE, WASH

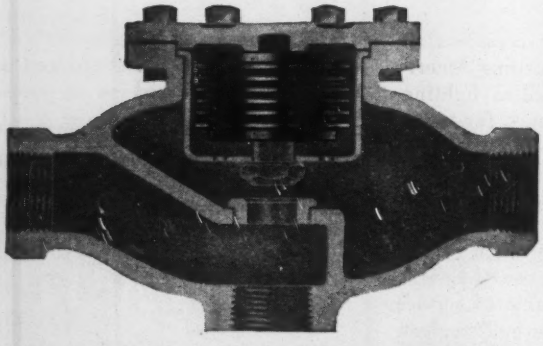


CMH
Stainless Steel Bellows

Wherever stainless steel's corrosion resistant qualities and temperature values are required in bellows service, CMH unimetal **circular seam welded** assemblies are filling that need.

No Solder or Flux Required

Long lengths of CMH Bellows are standard production; strength is further enhanced with **multiple ply** assemblies when needed.

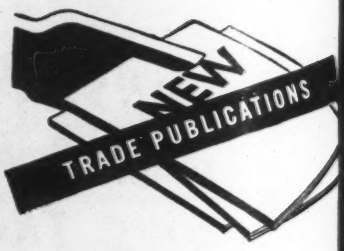


Ask for engineering recommendations on specific applications.

CHICAGO METAL HOSE CORPORATION

General Offices: MAYWOOD, ILLINOIS

Factories: Maywood and Elgin, Illinois



All about Forests and Lumber—A fas cinating illustrated book has been put ou with the title "Paul Bunyan's Quiz." I contains 225 questions and answers abou the forests and wood products. It goe into the history of forestry, loggers' lore forest resources, forest enemies, and forest products manufacture.—*American Forest Products Industries, Inc., 131 Eighteenth St., N.W., Washington 6, D. C.*

Industrial Greases—A booklet dis cusses the standards by which a good grease should be judged. It points out the various factors which should influ ence the selection of the proper grease for a specific job. It cites specific appli cations of greases and results obtained It is of value to any industrial enginee or production man interested in lubri cation.—*Sun Oil Company, Dept. 62 1608 Walnut St., Philadelphia, 3, Pa.*

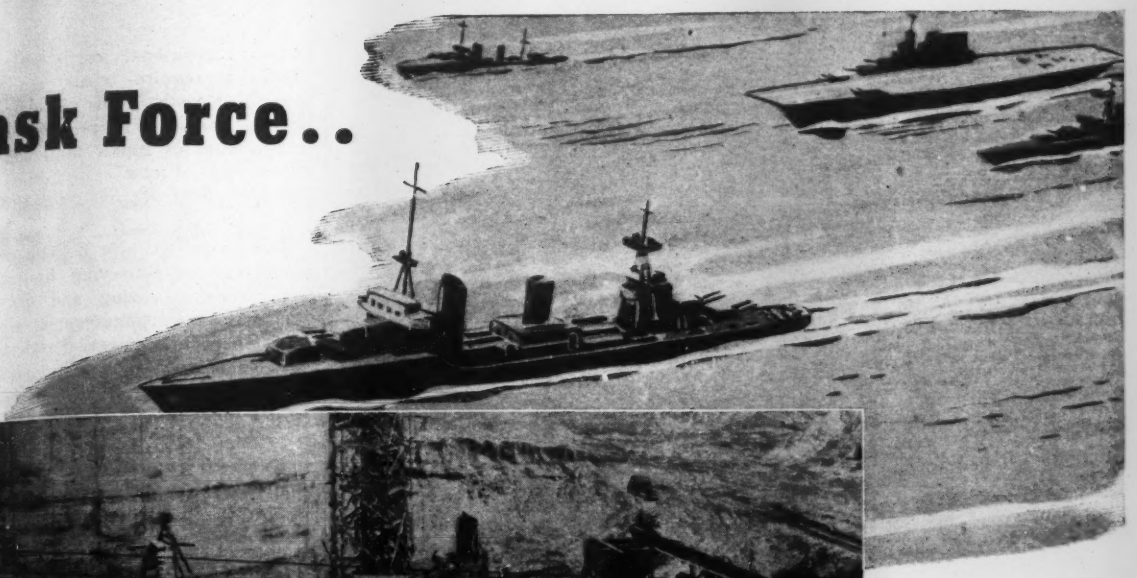
Air Compressors—An attractive and handy catalog of portable and stationary air compressors has just been issued.— *Schramm, Inc., West Chester, Pa.*

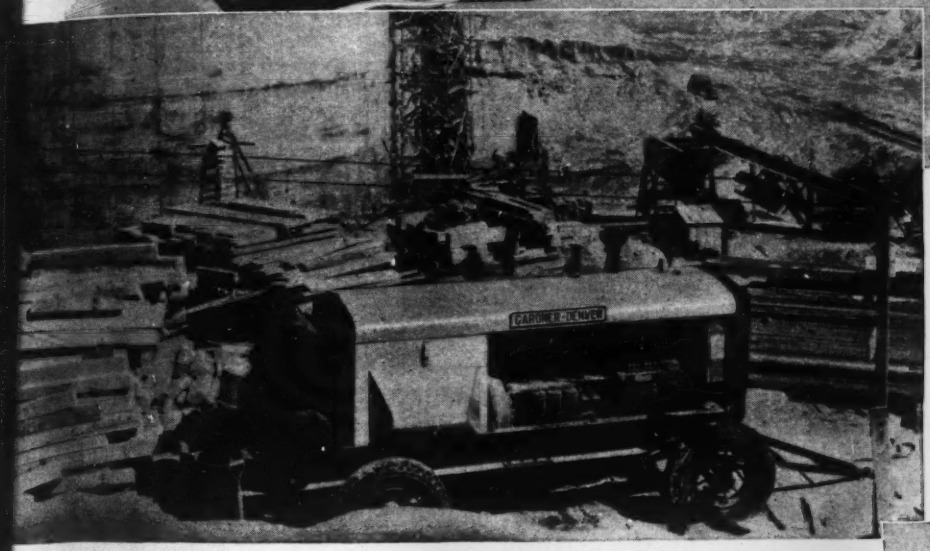
Metal Cutting Machine—A folder of interest to anyone who has a heavy-duty metal cutting job to do describes a new "wet-cut" metal cutting machine.—*De Walt Products Corp., Lancaster, Pa.*

Water, Sewage and Waste Treatment Here is a 40-page catalog of equipment for water, sewage, and industrial waste treatment plants by mechanical means The company offers the benefits of more than sixty years experience in this line —*Jeffrey Mfg. Co., Columbus 16, Ohio*

Underwater Cutting Torch — A bul letin describes an underwater cutting torch for which these advantages, among others, are claimed: Weight as light as sturdy construction permits; the elimination of all unnecessary external gadgets which would catch in the diver's outfit; control valves for oxygen, fuel gas and compressed air which can be conveniently handled with heavy gloves and are not confusing in the dark; a high pressure oxygen valve lever con veniently located and provided with an easily workable locking device to avoid unnecessary fatigue while cutting in

Task Force..





YOU'VE heard of task forces—those units trained to do their tasks in the quickest, most efficient manner possible.

That same description applies to Gardner-Denver construction equipment. ble and willing to travel to a job, do it in the fastest, most economical manner d return to their headquarters ready for the next job, Gardner-Denver task rces are helping speed up construction of air bases, barracks and many other ilitary installations.

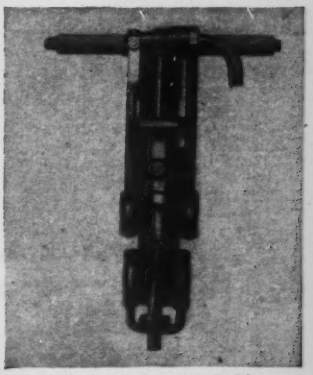
Gardner-Denver water-cooled portable compressors are particularly striking amples of this ability. Equally efficient in desert heat or arctic cold—at sea vel or high on a mountain side—they keep delivering at peak capacity.

RDNER-DENVER UM-99 WAGON DRILLS are conveniently portable, and once on the b, can be quickly adjusted to any type of drilling—down holes, toe holes or r broaching. They are equipped for 6-foot steel changes—speed up drilling deep holes.

E S-55 SINKING DRILLS are noted for their perfect balance, speed and low main- nance. They cut down fatigue and increase footage—are precision-built for tter balance and greater speed and power.

r complete information on Gardner-Denver construction equipment, write for scriptive bulletins. Gardner-Denver Company, Quincy, Illinois.

Gardner-Denver UM-99 Wagon Drill



Gardner-Denver S-55 Wagon Drill

Since 1859

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CRESCENT BUCKET
An Exclusive Sauerman Feature

ALL Sauerman Drag Scraper machines and Tower Machines use the Crescent scraper bucket. This streamlined bucket penetrates hard materials with the ease of a plowshare, and both in digging and conveying it requires much less line-pull than any other scraper of equal rated capacity. It digs a heaping load in a few seconds, moves this load rapidly over the ground, dumps cleanly when it reaches the dumping point and then returns at high speed for another load.

WRITE FOR CATALOGS

Typical small and large scraper jobs are illustrated and explained in our Catalog 19-A, together with details of Sauerman Scraper Machines. Other Sauerman catalogs describe Slackline Cableway Excavators, Tautline Cableways, etc. Copies of these booklets mailed free on request.

THOUSANDS of contractors have found that Sauerman machines make easy work of many excavating problems that would be complicated and costly by any other method.

Digging, hauling and automatic dumping are merged into a continuous operation controlled by one operator. Power requirement is moderate. Maintenance is simple.

Pictured above is a Sauerman Tower Machine equipped with a 4 cu. yd. Crescent scraper bucket making the excavation for the aeration tanks of a large sewage treatment plant. From 160 to 180 cu. yd. per hour was dug, hauled and loaded into cars by the one-man Sauerman machine. The entire excavation—1250′ long, 360′ wide and 30′ deep—was completed in 182 working days.

Sauerman machines are made in a wide range of sizes with handling capacities from 10 to 60 cu. yd. per hour and operating spans from 200 to 1500 ft.

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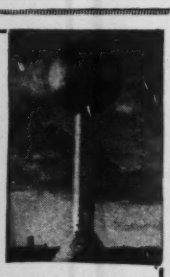
PREVENT RUSTING

Get permanent protection against rusting of water tanks, piping, and steel structures with our proven cathodic Electrical Corrosion Control. Approved by hundreds of enthusiastic users from coast to coast.

Initial cost of a complete installation is about equal to the cost of a good paint job. Operation costs only about 2 mills (i.e. $0.002) per year per square foot of surface protected. Electrode type, or our new Elecrode-less type, that keeps all parts of the system on the outside of the tank to avoid fouling from icing. Send for full details today!



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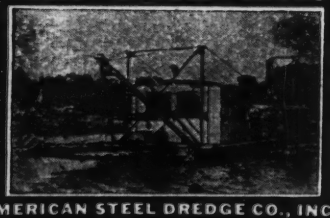

AMERICAN STEEL DREDGE CO., INC.
Fort Wayne, Ind.
Write for Bulletin RD-102

awkward positions; and a torch which should it require repair, can be disassembled easily, needs no soldered connections, and con be reconditioned with a minimum of repair tools and repair experience.—*Victor Equipment Co., 844-54 Folsom St., San Francisco, Calif.*

Conveyors—A new bulletin describes machinery for conveying, hoisting, storing, crushing, sizing and distributing such things as: aggregates, ashes, asphalt, bauxite, cement, chemicals, clay, coal, coke, earth, gravel, lime, limestone and other bulk materials.—*Robins Conveyors Inc., Passaic, N. J.*

Research and Development—The inside story of the development of new products and the improvement of present ones is told in an unusually attractive brochure. It covers the research laboratory, materials testing and analysis, physical tests and experiments, and gives a preview of production to come.—*Square D Company, 111 Eighth Ave., New York, N. Y.*

Sanitation Equipment—Two new bulletine have been put out by this company one describing in detail up-to-date sanitation equipment and the other dealing with tube mills.—*Hardinge Co., Inc., York, Pa.*

Electric Industrial Trucks—To acquaint industry with its war-standardized line of electric industrial trucks, this manufacturer recently published a 76-page catalog, containing detailed descriptions of all models, as well as a great many application illustrations, showing diverse uses of industrial power trucks. A separate section is devoted to the workings of the War Production Board's Limitation Order No. L 112, as applied to these industrial trucks.—*Yale & Towne Mfg. Co., Philadelphia, Pa.*

Glued Wood—A new chart illustrates the use of glued wood as a war production material, and also tells about a brand new type of glue-non-acid, low temperature phenol-resin. This is a glue that makes possible joint gluing and laminating with the same maximum durability obtained in the finest hot press plywood.—*Casein Company of America, 350 Madison Ave., New York, 17, N. Y.*

Fighting Horsepower—A new 16-page booklet gives a graphic portrayal of the part this manufacturer's products are playing in the war.

Important chores on many fronts, including the Aleutians, Africa, the Arctic, New Guinea, Great Britain, Mediterranean and New Caledonia are pictured and

TALK ABOUT GREASED LIGHTNING...

"Like a bat out of hell!" That's what flyers say of the P-38—one of the fastest and most versatile U. S. fighter planes. Called the "fork-tailed devil" by beaten German Focke-Wulfe and Jap Zero pilots, Lockheed's twin-engined P-38 can power-dive over 780 miles per hour—faster than the speed of sound!

The ever-changing warplane . . . ever faster, ever safer, ever deadlier, is a tribute to America's designers and draftsmen. Using high-speed *Typhonite* Eldorado pencils, their drawings reproduce without loss of detail or quality—resulting in sharp, easy-to-read blueprints. Typhonite leads are uniform, dustless; give crisp, clean, opaque lines of unmistakable clarity.

PENCIL SALES DEPARTMENT 227-J11, JOSEPH DIXON CRUCIBLE COMPANY, JERSEY CITY 3, N. J.

described. For a free copy of this publication request Form D324.—*Caterpillar Tractor Co., Peoria, Ill.*

Plastics—The latest issue of Bakelite Review contains valuable technical data on the latest developments in plastics and their applications, including: a new process for molding resin-bonded plywoods; thin vinyl plastic film; plastic plumbing accessories; low-pressure molding of laminates, and molding instrument panels by the printing plate process.—*Bakelite Corp., 300 Madison Ave., New York, 17, N. Y.*

Fiber Glass—A 16-page beautifully illustrated booklet entitled "Fiberglas, a New Basic Material," has been issued to explain the development, properties, and process of manufacture of this product and its uses in war or peace. It points out that there are two basic types of Fiberglas fibers: those which are interlaced in a resilient wool-like mass for fabrication into bats, blankets, boards and other forms; and those which are twisted and plied into yarns and in turn woven into braids, tapes and cloths.—*Owens-Corning Fiberglas Corp., Toledo, Ohio.*

Lumber Design Specifications—The application to engineering design of the "National Emergency Specifications for the Design, Fabrication and Erection of Stress Grade Lumber and Its Fastenings for Buildings—Directive 29," made mandatory by the War Production Board on and after Nov. 1, 1943, is simplified through use of the Wood Structural Design Data series of publications issued by the National Lumber Manufacturers Association, which has prepared a leaflet, entitled "Notice to Owners of Copies of W. S. D. D.," which tells how to use the series in conjunction with the WPB directive and specifications. The leaflet is available free upon request to the owners of past editions of this series. —*Information Department, National Lumber Manufacturers Association, Washington, 6, D. C.*

Lubricating Equipment—A catalog describing lubricating equipment has been issued. It features new lubrication items and a new price schedule. While all of the facilities of the company are fully engaged in the war effort, many items of lubricating equipment have recently been made available for civilian use. The new catalog details those now available to constructors and others employing lubricating units in the field. —*The Gray Company, Inc., Minneapolis, Minn.*

Pipe Tools—A large number and variety of pipe tools is listed in the new 48-page 1944 catalog of this manufac-

Why Industry *prefers* APS

THE PROTECTED STEEL ROOFING *and* SIDING

● APS is not just another roofing and siding—not a material offered as a mere substitute. APS is a superior *protected steel sheet,* with distinctive advantages for Industrial application. It is easy to erect, economical to maintain and readily available for all essential needs.

● APS gives positive protection against heat or cold, against fumes or acid gases, and withstands the corrosive effects of salt air. That's why APS sheets are preferred by industrial and chemical plants, why they are so widely used for storage buildings, hangars and all types of essential structures everywhere.

8

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General Office and Plant,
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to build an efficient

AIR COMPRESSOR

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Your Model A or B Ford Motor and a

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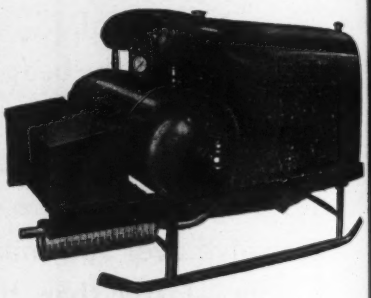
is all you need!



We furnish the following parts:

Smith Compressor Head fitted with high speed compressor valves and all other necessary parts such as motor governor, pilot valve, unloading and idling devices, air receiver, pop-off valve, pressure gauge, air cleaners for compressor cylinders and carburetor, axle and springs, tow connection and tool box.

You furnish the Ford Model A or B engine and also the Model A frame, hood, cowl, radiator and wheels.

You'll have a 60 cu. ft. Compressor with governed speed and automatic unloading and idling. You'll have all the power needed for a majority of compressor work. Thousands of compressors made with a Smith Compressor Head and Accessories are performing vital service for users the country over. Detailed instructions and drawings are furnished. Write, phone or wire, NOW!

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430 College St., Bowling Green, Ky.

GULF LUBRICANTS AND FUELS *help speed work on another important flight strip*

"Gulf Quality Petroleum Products have proven effective insurance against unnecessary delays due to mechanical failures and breakdowns,"

. . . says Superintendent Bill Burton

GRADING upwards to 15,000 yards of earth each day, the Mecklenburgh Construction Company of Durham, N. C. is rushing the flight strip, shown above, to completion ahead of schedule. Their equipment has made an exceptional performance record on this job with Gulf lubricants and fuels in service.

Like many other contractors doing rush war work throughout the country, this organization has found Gulf products provide maximum protection when equipment is pushed to the limit. Gulf fuels and lubricants are scientifically manufactured to meet the most exacting requirements.

Call in a Gulf Service Engineer today and ask him to check over your equipment. He will recommend lubricants and fuels best suited to your particular equipment and operating conditions.

The Gulf line of more than 400 quality products—are available to you through 1200 warehouses located in 30 states from Maine to New Mexico Write or 'phone your nearest Gulf office today.

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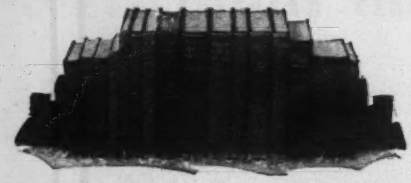

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A timely book, especially now with the renewed interest in timber design. All the basic information needed by the designing engineer is given here, with particular stress laid on timber connectors and glued laminated construction.

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For aeronautical designers and structural engineers. Volume I contains data and structural theory necessary for the structural design of airplanes. Volume II covers advanced problems in metal and plywood construction as well as statically indeterminate structures and beam-columns.

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For civil engineers and surveyors, the fundamental principles of both terrestrial and aerial photographic surveying and their application to map making. Includes chapters on the analytical solution of photogrammetric problems and the use of the most popular photogrammetric instruments.

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By Charles M. Gay and Harry Parker
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Rewritten to keep abreast of current practices in architectural construction, this book gives the latest uses of pressed wood, plastics and structural glass as well as the newest tables on the strength of materials and properties of structural steel. Also includes floor and roof construction, concrete design, and many other objects.

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For engineers who want a clear concise presentation of survey methods and computations. The book gives both fundamental theory and practical application of the proper use of astronomic coordinates, geodetic coordinates and plane coordinates, together with the computations needed to change from one system to another.

6) THEORETICAL SOIL MECHANICS
By Karl Terzaghi
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Here for the first time, tested theories of soil mechanics are completely treated and critically evaluated. The book affords a working knowledge of useful methods of analysis and shows the manifold factors that may influence the behavior of simple, ideal materials. Establishes the theoretical principles of earth pressure, stability and settlement computations.

7) STREAM FLOW—Measurements, Records and Their Uses
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Covers instruments, equipment and processes employed in field work related to the collection of systematic records of river discharge. Will help you to prepare stream flow records to report on projects for control, utilization and administration of river water, or to evaluate or adjudicate water rights. A book of real and lasting value.

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Contains simple, succinct explanations of all the usual reinforced concrete members in buildings. Includes numerous worked-out examples of design, an abundance of tables, and many typical problems for the reader to solve.

9) PLUMBING PRACTICE AND DESIGN
By Svend Plum
a) VOLUME I 315 PAGES $4.50
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A complete working library on plumbing. Volume I contains material on corrosion, materials, pipes and fittings, valves and controls, fixtures, pumps, fire protection, air piping and equipment. Volume II covers physical and chemical terms, codes, and regulations, architectural practice, water supply, sewage disposal, gas piping and appliances and many other subjects of interest to the practical engineer.

10) STRUCTURAL FRAMEWORKS
By Clyde T. Morris and Samuel T. Carpenter
272 PAGES $4.00

An essential book for engineers confronted with complex problems of modern industrial frameworks. The book contains an analysis of problems of the design of rigid-frame buildings, industrial plants, radio and transmission towers.

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turer. It is available on request by those interested. — *Beaver Pipe Tools, Inc., Warren, Ohio.*

Pumps — An unusually handsome booklet has been put out illustrating the products of the Peerless plants, virtually the entire output of which now consists of pumps and amphibian tanks for war use.—*Peerless Pump Division—Food Machinery Corp., 301 W. Avenue 26, Los Angeles 31, Calif.*

Cold Cathode Lighting—A new bulletin describes the differences between cold cathode lighting and fluorescent lighting. It briefly discusses the utility, adaptability, color harmonics, safety, efficiency and the future possibilities of the continuous tube (cold cathode) light source.

This catalog likewise illustrates eight installations of this form of lighting in retail stores, factories and business offices. Specifications and dimensions of four standard industrial type cold cathode lighting transformers and twelve commercial type cold cathode lighting transformers are included.—*Acme Electric & Mfg. Co., Cuba, New York.*

Modular Design—Widely accepted by the brick and tile industry, the 4-inch module as a unit of design for brick and file is an interesting new development. A booklet, "The ABC of Modular Masonry" describes the method thoroughly. —*Structural Clay Products Institute, 1756 K St. N. W., Washington 6, D. C.*

Radiant Heating—The subject of radiant heating is fully covered in a technical bulletin entitled "Byers Wrought Iron for Radiant Heating Installations." —*A. M. Byers, Pittsburgh, Pa.*

Reinforced Concrete—A 24-page booklet containing many charts, tables and other technical data has been published to tell of modern developments in reinforced concrete, the particular subject featured in the utmost detail being the design and construction of a 150-ton crane concrete runway at a U. S. Navy yard.—*Structural Bureau, Portland Cement Association, 33 West Grand Ave., Chicago, 10, Ill.*

Industrial Furnaces—This new bulletin illustrates and describes industrial furnaces used for various heat treating purposes.—*The Wellman Engineering Co., Cleveland, Ohio.*

Payroll Deductions—An ingenious cardboard wheel-like device has been put out to simplify the work of making pay-as-you-go tax payroll deductions. It is applicable to weekly or bi-weekly wage payments and to differences in

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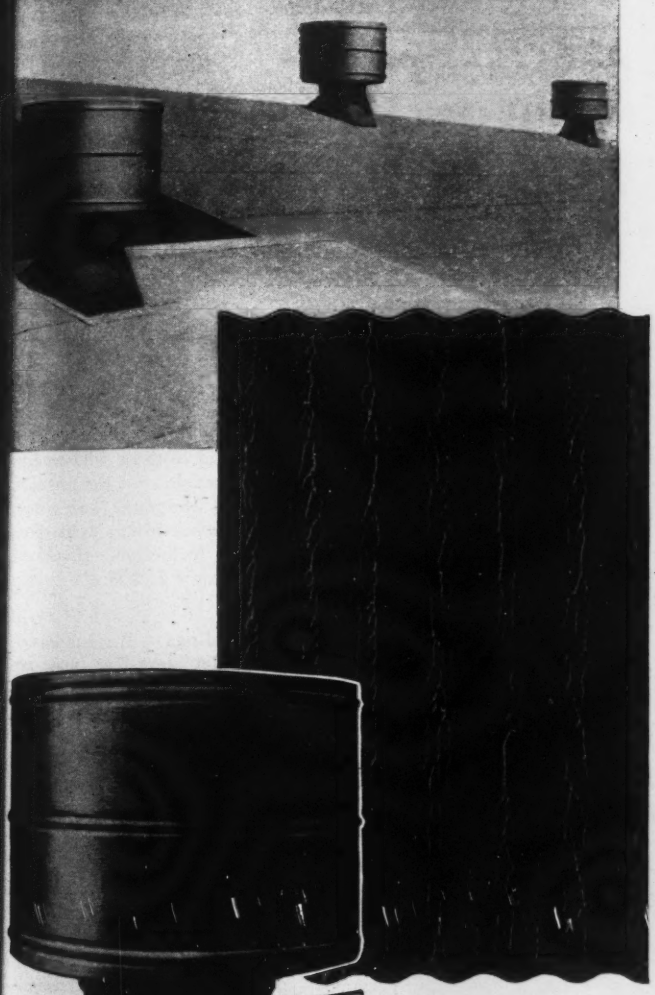

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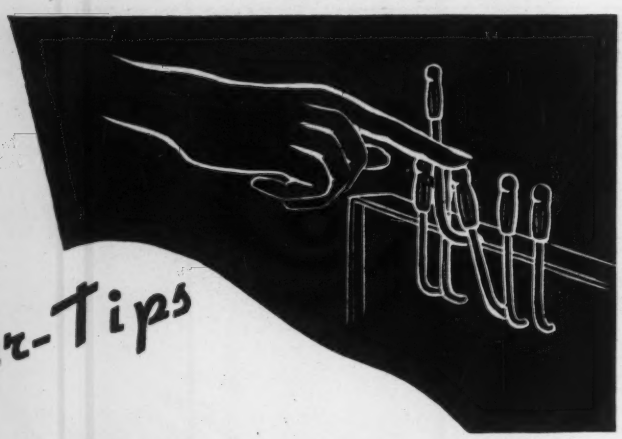

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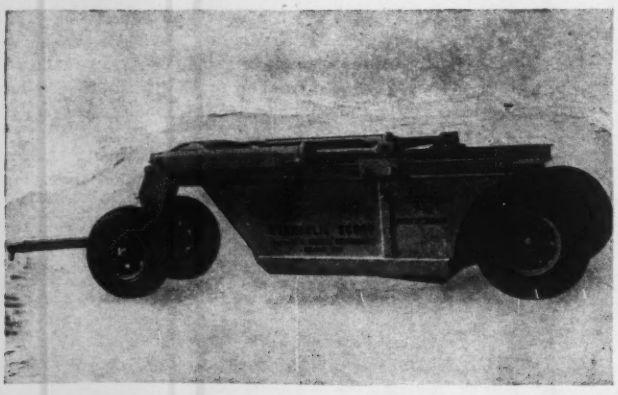

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marital status and dependents.—*George S. May Company, 2600 North Shore Ave., Chicago, Ill.*

Pipe and Tube Bending — There is a new and complete treatise showing methods and devices for bending pipes and tubes of copper and its alloys. This book contains 80 pages of text with 113 figures and illustrations, including 35 full pages of unit weights of tubes of different alloys with varying diameters, wall thicknesses and shapes, as well as pertinent information on the chemical and physical properties of such pipe material.—*Copper & Brass Research Association, 420 Lexington Ave., New York, 17, N. Y.*

Belt Conveyors — A 20-page engineering data book has been issued describing belt conveyor installations. It contains some valuable tables of engineering data and suggestions in design that will enable engineers to select conveyors of the proper size, speed and power.—*Industrial Division, Continental Gin Co., Birmingham, Ala.*

Wrench Catalog—A new wrench catalog, especially designed for busy wartime buyers, has been issued. It recognizes many emergency conditions. A dictionary of popular wrench terms is included as an aid to those who are buying and using wrenches for the first time. Another section illustrates how proper selection of wrenches brings extra speed, safety and utility to the job.—*Blackhawk Mfg. Co., Milwaukee 1, Wis.*

Postwar buildings — A handsomely illustrated booklet describes up-to-date building processes, particularly prefabrication of floors, roofs, walls, partitions, etc. It states that demountable steel buildings may be adapted to a wide variety of designs and uses, for the postwar era.—*H. H. Robertson Co., Farmers Bank Bldg., Pittsburgh, Pa.*

Pump Bulletin—Improved methods of pumping water from deep wells are described in a new pump bulletin. Two basic methods of raising water are illustrated — the turbine and by hypocycloidal. The difference between oil and water lubrication is also shown. Interesting cross-sectional views of deep well pumps, revealing the shafting and submerged pump elements graphically demonstrate the operation of lifting water from any depth. Various types of pump heads are included, to illustrate application of power, for direct motor connection, belted drives, geared power and combinations of these.—*Peerless Pump Company, 301 West Avenue 26, Los Angeles 31, Calif.*

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MEN AND JOBS

Col. George J. Zimmerman, formerly of Cincinnati, Ohio, and graduate of the University of Cincinnati, has been named acting director of the Middle Atlantic Division, Army Corps of Engineers, and acting director of the Third Service Command, Real Estate, Repairs and Utilities Division, with headquarters at Baltimore, Md.

Edward S. Cole, president of the Pitometer Log Co., New York, N. Y., received honorary membership in the American Water Works Association. The president of the association, Samuel B. Morris, dean of the School of Engineering, Stanford University, in presenting the membership made special reference to Mr. Cole's noteworthy contribution to the waterworks field.

Arthur A. Porath, county engineer and deputy highway commissioner of Brown County, Wis., has resigned to become a partner in the firm of Foth & Boyd, consulting engineers, with offices in Green Bay, Wis.

W. R. Eaton, of Chattanooga, Tenn., who has been associate engineer with the Tennessee office of the U. S. Geological Survey, has been transferred to Ashville, N. C., as engineer in charge of the Asheville office of the survey.

H. C. Creasman, senior engineering aide, has been stationed at Murphy, N. C., and will work under the Asheville office. Members of the Asheville staff under the revised program which has transferred the North Carolina headquarters to Raleigh are: **H. A. Taylor,** assistant engineer; **R. W. Leonard,** assistant engineer; **D. C. Murrow,** engineering aide; **H. A. Ballard,** hydrographic field assistant; **H. A. Whitman,** hydrographic field assistant; and **Miss Mary F. Griffin,** engineering aide. The Ashe-

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In 15 years of duty on Portland's water front, and in comparable terms of service in fire boats at Chicago and Ketchikan, Alaska, Cummins Diesels have consistently demonstrated their ability to provide maximum protection at a minimum cost in dollars, manpower and fuel.

Such economy—multiplied by the many thousands of Cummins Diesels doing scores of jobs essential to a nation at war—becomes doubly valuable now when every dollar and every man and every drop of fuel is so vitally needed to push the fight on the battle front and the home front. CUMMINS ENGINE COMPANY, Columbus, Indiana.

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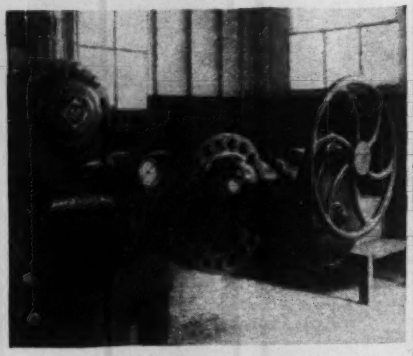

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V-19

LUDLOW VALVES

SINCE 1866

ville office will handle the Survey's work in western North Carolina and northern Georgia.

Edward L. Schmidt of Mt. Lebanon, district engineer of the Pennsylvania state highway department, has been appointed to a newly-created post as engineer in charge of the Penn-Lincoln Parkway project with headquarters at Pittsburgh.

Angus R. Wood, lately assistant engineer at St. John, N. B., has been named engineer of public works department at London, Ont.

The city commission of Marquette, Mich. has appointed **Stephen T. Garber** of Escanaba general manager of utilities and public works, Mr. Garber, a graduate of Lehigh University, spent 14 years as an industrial agent and assistant valuation engineer with the Pennsylvania Power & Light Company.

C. W. Mengel and **Charles Pearson** are supervising engineer and resident engineer, respectively, for the W. C. Olsen Company of Raleigh, N. C., on the construction of a 9-mi. pipeline to a new intake for the municipal water supply at Wilmington, N. C. A. W. Baldwin, veteran on construction of pipelines, is supervising the laying of 708 ft. of the line which extends under the Cape Fear River.

C. L. Erkine has retired as superintendent of sewage and drainage for the City of Ottawa, Ont.

Clarence E. Moran, a consultant engineer at Canton, Ohio, for the past six years, has been appointed utility consultant for the Canton area of the War Manpower Commission by Regional War Manpower Commission Director E. L. Keenan.

Nelson Lee Smith of Hopkinton, N. H., who was nominated by President Roosevelt as a member of the Federal Power Commission, took oath of office Oct. 26, for a term expiring June 22, 1945. He succeeds the late Commissioner Clyde L. Seavey.

Albert J. Raver, rod man and assistant county engineer of Greene County, Ia., for about 24 years, has been named acting county engineer to replace C. Arthur Elliott, who has entered the armed forces. His headquarters are at Jefferson, Ia.

Maj. Luther L. Watkins has been placed in charge of the engineering division of the Jeffersonville, Ky. Quartermaster Depot. He succeeds Lt. Col. Arthur H. Rogow, assigned to the field headquarters, Quartermaster Corps inspection

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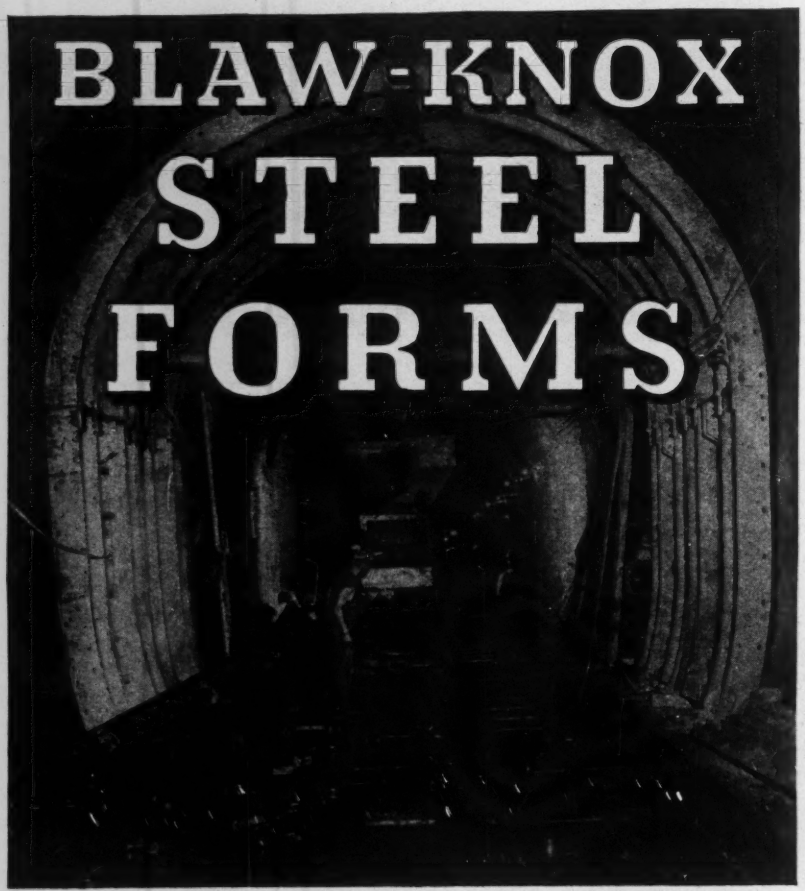

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service, New York City, as deputy director of procurement for inspection.

The New York Central System announces these changes in its engineering staff: **E. H. McGovern** is appointed district engineer at Cincinnati, Ohio, succeeding **Paul Hamilton,** who has retired after 43 years service. **E. J. Bayer** is appointed assistant district engineer. A. A. Keever is appointed division engineer of the Illinois Division, with headquarters at Mattoon, Ill., in place of **J. R. Scofield,** transferred.

Captain Stephen E. Kovack, Jr., assistant post engineer at Camp Butner, N. C., has been transferred to Morrison Field, West Palm Beach, Fla., in the same capacity.

Edward R. English, of Altavista, Va., has been promoted to the rank of captain from that of first lieutenant at Camp Butner, N. C., where he is engineering officer of the Post Engineering Division.

Col. R. G. Barrows, former district engineer at Detroit, Mich., for the U. S. Army Engineers, is now division engineer with headquarters at Chicago, Ill. He succeeded **Brig. Gen. L. D. Warsham,** who is now in charge of the northwest division, having been recently promoted from the rank of colonel. He will supervise work on the Alaskan Highway.

W. W. Towne, formerly director of the division of sanitary engineering, South Dakota State Board of Health, is now a captain in the Sanitary Corps, U. S. Army. At present he is stationed at Camp Lee, Va.

Robert C. Boyd, assistant highway engineer at Ottumwa, Ia., for the past six years, has been transferred to Ames and elevated to district highway engineer of the first Iowa district. He succeeds **Clarence L. Bleason,** who has been commissioned an officer in the Navy Seabees and is now training at Williamsburg, Va.

William E. O'Brien has resigned his post as a member of the Wisconsin Highway Commission to become state director of the War Manpower Commission. D. J. Summerville of Ladysmith was appointed to succeed Mr. O'Brien. Mr. Summerville has served Rusk County for 19 years as highway commissioner and is a past president of Wisconsin County Highway Commissioners Association.

John W. Crenshaw, who has been connected with the post engineer's office at Camp Davis, N. C., has been named senior engineer and superintendent of construction and maintenance at Camp Butner, N. C. A graduate of the University of Kentucky and a member of the Amer-

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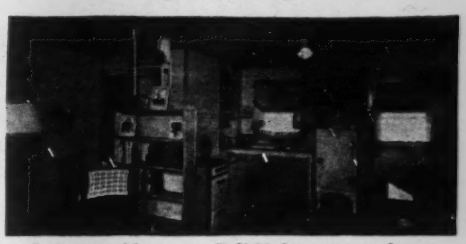

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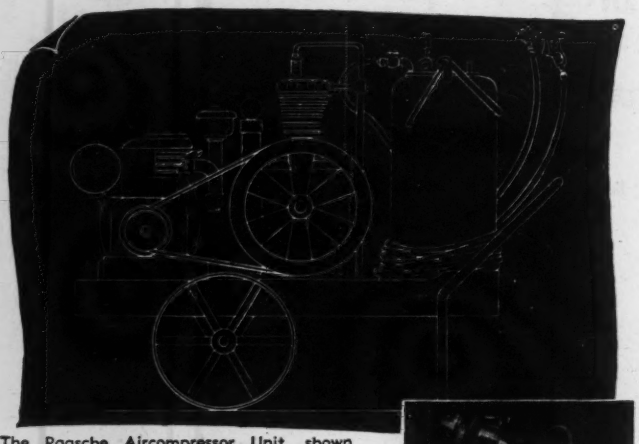

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ican Society of Civil Engineers, Crenshaw was engaged in municipal consultant work for eight years prior to becoming associated with the engineer's office at Camp Davis. For seven years he was with the New York Central Railroad, and served for a number of years as engineer for the North Carolina Highway and Public Works Commission.

Harvey W. L. Doane, engineer and manager of Standard Paving Maritime, Ltd., Halifax, N. S., will become Commissioner of Works of Halifax.

R. L. Clayton, assistant county engineer at Waco, Tex., for 22 years, has resigned to teach mathematics at Baylor University. Clayton is succeeded in the office of assistant county engineer by **James Cochran,** former county map maker.

Col. Jarvis J. Bain, builder of the first American fortifications on Corregidor and district engineer of the Memphis District, United States Engineers, has been retired, and **Lt. Col. Garner W. Miller,** chief of the operations division, has been appointed district engineer. Colonel Miller took over at the Memphis District office at West Memphis as Colonel Bain began taking his terminal leave preparatory to his retirement Dec. 10.

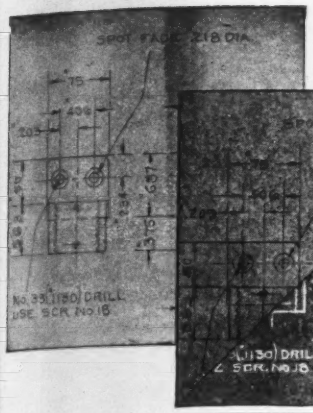
Stephen J. Tully, Jr., building contractor of Houston, Tex., has been appointed district director of the 40-county Houston OPA district. Some of Mr. Tully's outstanding achievements are his planning and supervising of the development of Houston subdivision projects, among which is Southwood Oaks in the North MacGregor Way section.

Col. James G. Truitt, officer in charge of construction for the Seattle district of the U. S. Army Engineers, has been transferred to an undisclosed army assignment.

Otto W. Croy, Portland, Ore., public works analyst, has been appointed by the Idaho planning board as consultant and project director for the Board's Idaho improvement program. He previously had served with the National Resources Planning Board.

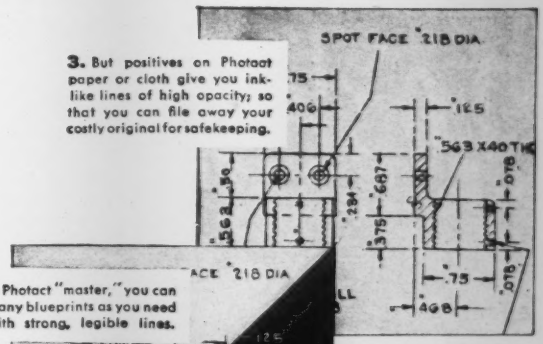
Roy S. Braden, former city manager of Hopewell, Va., is town manager of High Point, N. C. Until recently he was town manager of Greenbelt, Md., which position he held for seven years.

Lt. Howard G. Lindstrom, son of John A. Lindstrom of Lindstrom & Anderson, contractors of St. Paul, Minn., now stationed at Fort Eustis, Va., has received a commission as First Lieutenant. He was formerly with the above firm. He

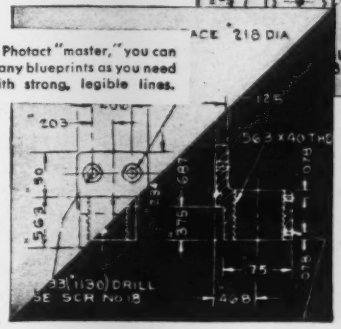


1. Your costly time-taking pencil originals deserve the best of help in performing their important tasks.

2. After a long run of blueprints, however, the lines on a pencil original become smudged and weak, so that the blueprints made from them are often hazy and illegible.



3. But positives on Photact paper or cloth give you ink-like lines of high opacity; so that you can file away your costly original for safekeeping.



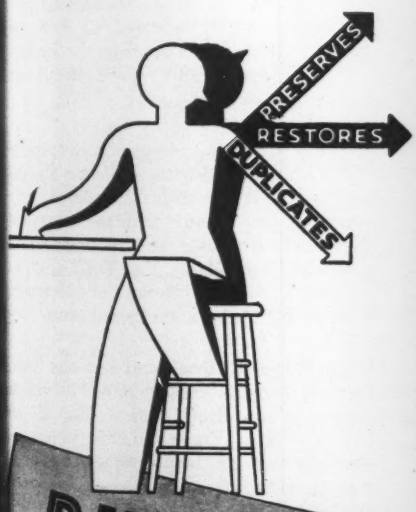
4. With a Photact "master," you can make as many blueprints as you need —each with strong, legible lines.

K+E TRADE MARK

STRONGER LINES

IN BLUEPRINTS

from pencil originals



PRESERVES: Photact *preserves* originals—the Photact print takes the place of the original as a "master" for reproduction and future reference.

RESTORES: Photact *restores* old, worn-out tracings —cracks, smudges, etc., can be easily eliminated from the negatives so they will not appear in the finished Photact prints.

DUPLICATES: Photact *duplicates* originals—as many "second" originals as may be needed can be reproduced from the negative on Photact tracing paper or cloth.

Today's pressure for speed in product production requires increased quantities of highly legible blueprints, brownprints and black-line prints made from pencil drawings.

But pencil drawings, with all their advantages of speed and ease of correction, have a low opacity of line—and a tendency to smudge under frequent handling. As a result, blueprints from pencil originals generally do not have sufficiently strong lines for quick legibility.

Photact reproductions, on the other hand, have lines of high opacity which will not smudge or blur, so that large quantities of blueprints of consistent legibility can be made from Photact "masters."

For complete information about the Photact Process and Photact Papers and Cloths, write: Photact Dept., KEUFFEL & ESSER CO., Third & Adams Streets, Hoboken, N. J.

PHOTACT
TRADE MARK
Reproduction
PAPERS AND CLOTHS

EST. 1867

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Why they all prefer the SAFETOP

Write for full information

The WATER DEPARTMENT SUPT. likes Safetop *Economy* - -
Negligible maintenance expense, ample strength to resist breakage from ordinary impacts, and repair costs that are less than 1/5 those of other hydrant designs in case of breakage due to smashing collisions.

The FIRE CHIEF likes Safetop *Convenience* - -
Convenient nozzle height, nozzle caps that unscrew quickly and drop out of the way, simple straightline operating mechanism, and full main pressure at the nozzles.

The HYDRANT MAINTENANCE MAN likes Safetop *Reliability* - -
Freedom from trouble calls, because Safetops are flood-proof, frost-proof, corrosion-proof and tamper-proof. In addition, they are readily lubricated, and their tough, grit-resisting valve facings last indefinitely.

The NEIGHBORHOOD HOUSEHOLDER likes Safetop *Protection* - -
No danger of flooding if accidentally broken, no interruption of water service or street excavation, and speedy return to service if breakage repairs or extension for change of street grade are necessary.

The TRUCK CHAUFFEUR likes Safetop *Safety* - -
No likelihood of serious personal injuries in case of unavoidable collision against the hydrant due to slippery streets or traffic accidents. No fire hydrant is worth a human life.

The Kennedy Valve Mfg. Co., Elmira, N. Y.

KENNEDY SAFETOP FIRE HYDRANT

ZIEGARTH CONSTRUCTION

800 West Esther Street, Long Beach, California
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IF YOU are responsible for the engineering, building or purchasing of heavy construction —by all means write for the new, informative "The Story of Ziebarth Construction"! It's gratis.

was inducted at Fort Snelling, Minn., in June, 1942, and spent 16 months in California. From there he went to Officers Training School at Camp Davis, S. C.

W. P. Hesterly, of Giddings, Tex., has been promoted to roadmaster for the Southern Pacific Railroad at Ennis, Tex., taking the place of the late R. M. Perdue.

Glen R. Blackburn has resumed as manager of the highway department of the Houston, Tex., Chamber of Commerce, after a leave of absence, to serve as chief engineer on the construction of a naval ammunition depot in Oklahoma.

George I. Popper, assistant post engineer at the Army Forces Depot, San Antonio, Tex., has been promoted to captain. **Carlton C. Massey** has resigned as town manager of Salem, Va., to become county manager of Henrico county, Va. He succeeds **Sterry J. Mahaffey,** who became city manager of Durham, N. C.

Frank W. Herring has been named chairman of the Non-Industrial Facilities Committee of the War Production Board, Washington, D. C. For the past few years Mr. Herring served as assistant director of the National Resources Planning Board.

John J. Connelly, of Bellows Falls, Vt., has been promoted from captain to major at Morris Field, Charlotte, N. C., where he is assistant personnel officer at the headquarters of the First Tactical Air Division. Connelly received his B. S. degree in civil engineering from the University of Vermont and joined the Army Air Forces in 1941.

M. Clare Miller has resigned as a member of the board of directors of the Kansas Contractors Association. He was recently commissioned a captain in the army and is now in training at the engineering school at Fort Belvoir, Va. The board has appointed **Gerold Reno,** of Merriam, Kan., to fill Miller's unexpired term.

Capt. Milton B. Roelfs, of Lincoln, Neb., recently became area engineer in charge of the Scotts Bluff, Neb., office of the United States Engineers. He succeeds **Capt. Bernard T. Hensgen,** who has been transferred to the district engineer's office at Omaha.

Recent personnel changes in District Engineer's Office for the Texas State Highway Department, as announced by D. C. Greer, State Highway Engineer, are as follows: **Clifton Rice,** district engineer of District 24 at El Paso has resigned because of ill health and has accepted a special assignment with the Department

In any Climate... On any Job...

DAVEY COMPRESSORS

RESIST WARTIME WEAR
FULL TIME PLUS OVERTIME

WARTIME CONSERVATION POINTERS

By "Davey Dan," the Compressor Man

★

AIR CLEANERS. These filters pay big "service dividends" for the small amount of attention required. Examine one of the filters every day. If it needs cleaning, the others will need it also. Empty and clean the sediment bowl. Fill with clean engine oil, level with bottom bead. Wash filtering element with oil and blow out with air. Never use gasoline or kerosene for cleaning air filters because such practice may lead to explosions in the air receiver.

★

PRESSURE GAGES. Should be checked periodically with a master gage.

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SAFETY VALVES. Keep them clean and in working order by blowing at least once a day.

★

PACKINGS. Keep all packings on air joints snug enough so that no air is wasted through leakage.

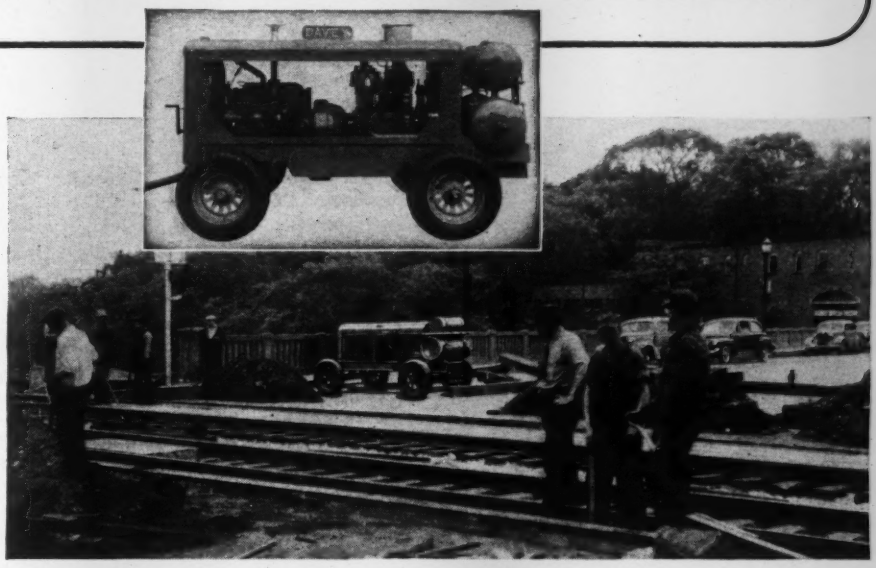
★

FAN BELTS. V-belts should be tight enough to prevent excessive slippage but not as tight as a flat belt used under similar conditions.

★

ENGINE SPARK PLUGS. Keep the electrodes clean and spark gap properly adjusted. Never attempt to bend the center electrode as this will crack the porcelain.

★



Here's Why Davey Compressors Stand Today's Crucial Tests

1. RUGGEDNESS. The outstanding characteristic of EVERY Davey Compressor is the ability to "take it" and come back for more in any CLIMATE or on any JOB. From the smallest pin to the heavy gage steel frame, every part of a Davey Compressor is designed and built so that, like a mountain locomotive, it always has a reserve of rugged endurance to get you "over the hump."

2. CONSERVATIVE SPEED. Davey Compressors operate at moderate speeds, reducing operating trouble, minimizing maintenance costs, and greatly extending the life of the equipment. Engineering leadership, maintained through the years, today offers you the ONLY compressor with GUARANTEED LIFETIME VALVES—guaranteed to operate satisfactorily in any climate . . . on any job — to resist wartime wear everywhere.

DAVEY Portable Compressors are available in the following sizes: 60-105 (illustrated)—160-210-315 cubic foot sizes, with gasoline, Diesel or electric power. Write for catalog showing complete DAVEY line.

★ ★ ★ ★ ★ ★ ★

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DAVEY Compressor Co.
KENT, OHIO

McCRACKEN Machines Make:
Soil Pipe—Drain Tile—Culvert Pipe—Conduit. Either plain or reinforced. 4" thru to 36".

1. At the Highest Speed
2. Of the Highest Quality
3. At the Lowest Cost
4. In Any Location

McCRACKEN PIPE

Corrugated

CONCRETE PIPE MACHINERY CO.
• Sioux City, Iowa, U.S.A.

at Austin. Mr. Rice has served as district engineer continuously since September 1, 1929. **P. S. Bailey,** who has been district engineer at Childress for the past three years, will succeed Mr. Rice as district engineer at El Paso. **John B. Nabers,** who has been district engineer for the past five years at Lufkin, and who was formerly district engineer at Childress, will succeed Mr. Bailey as district engineer of District 25 at Childress. **V. G. Koch,** who has been assistant district engineer at District No. 11 at Lufkin for the past eleven and one-half years will succeed Mr. Nabers as district engineer at Lufkin.

Arthur E. Turner has been appointed assistant city engineer of Oakland, Calif.

C. N. Billings, of Victoria, Tex., has been made division engineer of the Southern Pacific Railroad at Ennis, Tex.

H. R. Topping has been appointed director of public works, at St. Petersburg, Fla., to succeed Frank O. Lee. Mr. Topping will continue as superintendent of streets, the position he has held for several years.

Thomas J. Evans, Coaldale, Pa., has been named chairman of the Pennsylvania Turnpike Commission to succeed Walter A. Jones.

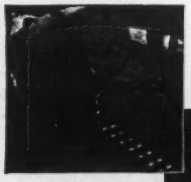
J. J. Woltman has been appointed acting chief of the state water survey at Urbana, Ill. **Dr. A. M. Buswell,** chief of the survey, has taken a leave of absence to join the army.

Paul M. Keith, for 10 years an engineer with the Arkansas State Highway Department before joining the United States Engineers at Little Rock, has reported to Camp Peary, Williamsburg, Va., as chief petty officer in the Seabees.

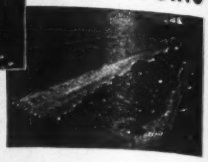
Sydney J. Shank, superintendent of the city water and sewage disposal systems at Escanaba, Mich., for the past six years, has resigned to become sanitary engineer of the Willow Run housing area at Ann Arbor, Mich. Mr. Shank had been water plant superintendent at Flint, Mich., for seven years prior to his employment at Escanaba.

Willis E. Collins, former city sanitary engineer of San Antonio, Tex., has received his commission as a captain in the army sanitary corps and has reported for duty at Camp Barkley.

Jack Saunders, night superintendent for Stone & Webster Engineering Corp. on the butyl rubber project, Baytown, Tex., has been appointed captain in the Corps of Engineers and will be stationed temporarily at Ft. Belvoir, Va. Prior to his



KEEP YOUR CONVEYOR BELTS GOING



FLEXCO H D RIP PLATES are used in repairing rips and patching conveyor belts. Their use saves expensive replacements and extended shutdowns.

FLEXCO H D BELT FASTENERS make a strong, tight butt joint with long life. Recessed plates embed in belt, compress belt ends and prevent ply separation. Six sizes in steel and alloys.

• Avoid shutdowns and lengthen the life of your conveyor belts and bucket elevator belts by using Flexco belt fasteners. Thousands of companies have stepped up the performance of conveyor lines and cut costs by using Flexco methods.

Bulletin F-100 shows exactly how to make tight butt joints in conveyor belts with Flexco. Also illustrates step by step the latest practice in repairing rips and putting in patches.

FLEXIBLE STEEL LACING CO.
4656 Lexington St., Chicago

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FLEXCO H D BELT FASTENERS

Sold by supply houses everywhere

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CONCRETE SURFACERS

Model RC1-A

Concrete Surfacers, Concrete Vibrators and Hiway Surfacers for concrete construction.

Cleaning, grinding, wire brushing, sanding and polishing equipment—for use on wood and metal surfaces. Available in electric motor and gasoline engine driven models.

THE CONCRETE SURFACING MACHINERY CO.

4667 Spring Grove Ave.,
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A TRUCK-TRAILER DRIVES UP

NEED A THOUSAND HOUSES? One or a thousand, the process is the same for National Homes. In fact, 4,000 are now being erected on one order in the Detroit area. Other large groups have been erected in Indiana, Illinois, Nebraska and Wisconsin.

Thanks to our network of roads and the efficiency of Trailer hauling, these homes are practical throughout most of the United States. They have been erected as far as 700 miles from the factory. *Truck-Trailer hauling is economical, too. National's Fruehauf Trailers, carrying 10-ton loads, are pulled by 1½-ton trucks.*

and PRESTO - there's Your New Home!

The erection of your new home can be almost as fast as Presto! . . . thanks to National Homes Corporation's assembly-line production and its use of Truck-Trailers* for delivery from factory direct to homesite.

The construction time for a 5-room house is about four hours . . . one for the floor, three for the upper structure. Then, a few days for plumbing, wiring, painting and heating installation . . . and you move in.

Or, if you move to another location, your National Home can be demounted and re-erected in seven hours, plus the transportation time by Trailer. And these are just normal operations with a small crew . . . not stunts with an army of workmen.

**National Homes house sections are transported by Bud Marks Truck Service.*

Mass production and fast, synchronized transportation are, of course, the answers. And, as so many other companies have learned, Truck-Trailers do a transportation job that wouldn't be practical any other way.

In this case, the house sections are loaded at the National Homes factory in Lafayette, Indiana . . . go direct to the new homesite . . . are unloaded as the building goes up.

War workers are now getting the homes that National's fleet of Fruehauf Trailers are transporting. After the war, a host of other American families will likely choose these attractive homes that they can take with them wherever they go.

World's Largest Builders of Truck-Trailers

FRUEHAUF TRAILER CO. ◆ DETROIT

Service in All Principal Cities

BASH THE BARRIERS!

A motor transport operator has a regular run between Los Angeles and Denver, requiring six truck-and-trailer units. The route traverses six States. Although each vehicle goes through each State only one day in four, each must carry the license plates of all six, at almost prohibitive cost. This type of trade barrier, duplicated throughout the country—the taxing of interstate vehicles the same amount as intrastate vehicles, regardless of their use of the highways—is a burden to the public. The solution? Reciprocity between States!

A TRUCK IS LIKE A HORSE — IT CAN PULL MORE THAN IT CAN CARRY

FRUEHAUF *Trailers*

"Engineered Transportation"

TRUCK-TRAILER TRANSPORT IS DOING AN ESSENTIAL JOB FOR ALL AMERICA

"TERMITES?"

Almost as troublesome as termites are drawing pencils you can't rely on.

But you can rely on the Venus Drawing Pencil. Each Venus Drawing degree is exact and unvarying — so that a 2H, for instance, is *always* the same, identical 2H. That's vital — and it's true of all 17 Venus Drawing degrees. Venus Drawing Lead holds the point you give it—and is smooth, from first sharpening to final stub ... Because they can rely on it, more draftsmen, architects and engineers use Venus Drawing than any other make.

May we send you *free* samples of Venus Drawing—so you can test it yourself at our expense? Simply mail us the coupon below—circling the two degrees you would like to try.

VENUS *Drawing* PENCILS

American Pencil Company
Dept. 184, 500 Willow Ave., Hoboken, N. J.
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Please send FREE samples of the two grades circled:
9H - 8H - 7H - 6H - 5H - 4H - 3H - 2H - H - F - HB - B - 2B - 3B - 4B - 5B - 6B

NAME and title _____

FIRM NAME _____

ADDRESS _____

CITY _____ STATE _____

Stone & Webster job, he was chief of the civil engineers on the Oklahoma ordnance works, Pryor, Okla.

Arthur L. Mercer, of L. M. Mercer & Son Co., Reading, Mass., has been appointed captain in the Army Engineers. He has taken up his duties in the diving school at Fort Scrivan, Ga. Ralph C. Nash will manage the firm in Mr. Mercer's absence.

These three engineering officers of the Little Rock, Ark., district U. S. Engineers, have been assigned to the Engineer School, Ft. Belvoir, Va.: **Maj. Leonard J. White, Capt. Marshall A. Patch,** and Lt. **Francis C. Baldwin.**

W. W. Thorn, division maintenance engineer of the Iowa State Highway Commission, has resigned to accept a position with Consolidated Vultee Aircraft Corp., San Diego, Calif. **R. S. Mushrush,** maintenance project engineer at Cedar Rapids, has been named to replace him at Grinnell.

Martin W. Kehart, Civil Engineer Corps, U. S. Naval Reserve, officer-in-charge of construction and public works, Naval Training Station, Farragut, Ida., has been promoted to the rank of commander. He was formerly engaged in building and bridge construction and design for Arkansas at Little Rock.

Ben Hoeck has been commissioned a lieutenant, Naval Procurement, in the Seabees. He has been with the Arkansas State Highway Department for the past 12 years.

Lt. Col. E. L. Beriswill, United States Engineer, has succeeded Col. P. A. Feringa as officer in charge of the Savannah, Ga., district. Colonel Beriswill went to Savannah from Mobile, Ala., where he was associated with the district engineer office.

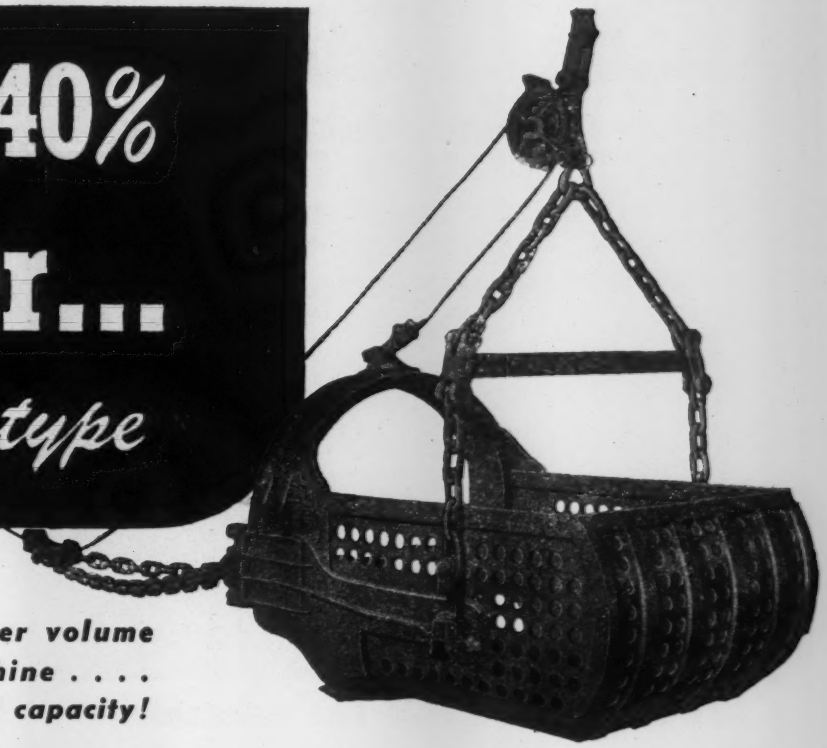
Maj. John W. Hunter, of Raleigh, N. C., is post engineer and officer in charge of maintenance and construction at the Army Ordnance Depot at Charleston, N. C.

Capt. L. C. Pittman is now with the Army engineer organization in England. His last assignment here was as area engineer in charge of construction of the Wilmington, N. C., Army Air Base, just completed, under the Wilmington Engineer District.

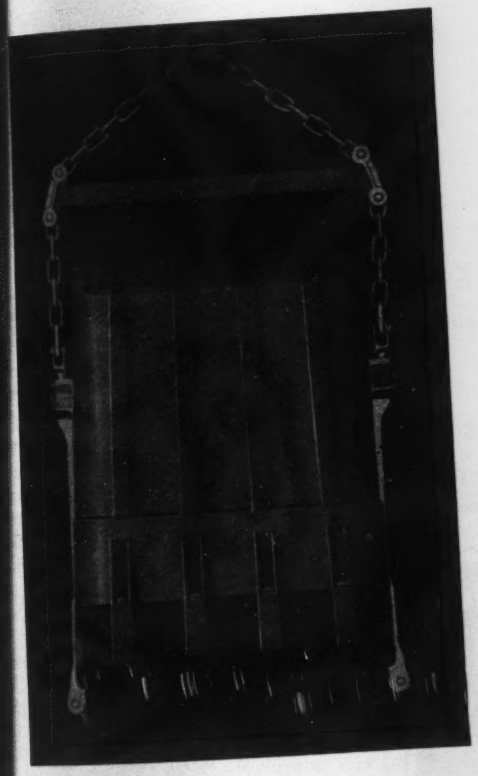
J. P. Camery, Harlan, Ia., has been granted a leave of absence as Shelby county engineer to work with the Western Engineering Co. of Harlan on the Alcan Highway. **Lyle Martin,** his assistant, will be in charge of the county office.

20% to 40% lighter...

type for type



Permits use of larger volume bucket on your machine . . . . regardless of <u>normal</u> capacity!



Here's the bucket every excavating contractor and dragline operator has dreamed of and wished for. A bucket that's light yet strong, unsurpassed for wet or dry digging, easy to handle, and with inbuilt durability to give years of trouble-free service. Light enough, even in the larger sizes, to maintain allowable loaded weight when used on small machines or on long boom.

If you want to speed up your operations under all digging conditions . . . move *more* material *faster* . . . you need Hendrix Lightweight Buckets for your draglines. Write today for descriptive literature, specifications and prices or *ask your dealer.*

1. **ALL WELDED CONSTRUCTION . . . *no rivets***
2. **10% to 14% MANGANESE STEEL CHAINS and FITTINGS**
3. **20% to 40% LIGHTER THAN OTHER BUCKETS, *type for type***
4. **GETS FULL LOAD OF PAY MATERIAL EVERY TRIP *even in wet digging***
5. **PERFECT BALANCE *for ease of handling***

HENDRIX *Lightweight* **DRAGLINE BUCKETS**

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CONTINENTAL RUBBER WORKS

'THE HAND OF THE SPECIALIST'

The Hand of the Specialist is Prepared for the 1944 Conversion to Synthetics

ARMY E NAVY

As the year comes to a close, Continental chemists are busy converting compounds from crude rubber to synthetics in accordance with Government regulations. This task is less difficult for Continental because it worked with synthetics for many years before the war and is well prepared to meet the situation by actual experience with all types of synthetics.

The diminishing supply of crude has made further curtailment obligatory and it is now clear that little or no crude will be available in the year ahead. But despite that fact, Continental's high standard of quality will be maintained at any cost. As a result of the industry's conversion from crude to synthetics, such a wealth of experience will be gained that the products of tomorrow will be destined to perform duties and render service beyond anything previously conceived in industrial rubber goods.

CONTINENTAL RUBBER WORKS *makers of the* VITALIC

ERIE, PENNSYLVANIA · U·S·A · *line for forty years*

THE MOUNT VERNON BRIDGE CO.

Engineers Contractors

STRUCTURAL STEEL

RAILWAY AND HIGHWAY BRIDGES

BUILDINGS AND VIADUCTS

MOUNT VERNON, OHIO

Fast, Dependable

SHOVELS, CRANES

DRAGLINES, BACK HOES

Crawler or Truck—Gas or Diesel

10 Models of 3/4-5/8-1/2-3/8 cu. yd.

THE BYERS MACHINE COMPANY

RAVENNA, OHIO

DISTRIBUTORS THROUGHOUT THE WORLD

MEETINGS

HIGHWAY RESEARCH BOARD, 23rd annual meeting, Edgewater Beach Hotel, Chicago, Ill., Nov. 27-30.

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS, annual meeting, Chicago Ill., Dec. 1-3.

JOINT MEETING, Society for Experimental Stress Analysis with Applied Mechanics Division, American Society of Mechanical Engineers, Hotel Pennsylvania, New York, N. Y., Dec. 2-4.

REGIONAL AND LOCAL MEETINGS

FLORIDA SECTION, AMERICAN WATER WORKS ASSOCIATION, 17th annual meeting and 2nd wartime conference, Governor's Club Hotel, Fort Lauderdale, Fla., Nov. 18-20.

VIRGINIA SECTION, AMERICAN WATER WORKS ASSOCIATION, 10th annual conference, Hotel Roanoke, Roanoke, Va., Nov. 22-23.

CAROLINAS BRANCH, ASSOCIATED GENERAL CONTRACTORS, Pinehurst, N. C., Dec. 6-7.

NEW YORK STATE HIGHWAY CHAPTER, 18th annual "victory conference," DeWitt Clinton Hotel, Albany, N. Y., Dec. 8-9.

Elections and Activities

R. E. Parmalee, Helena, Ark., has been elected president of the Arkansas State Board of Registration for Professional Engineers, succeeding C. S. Christian, Little Rock. V. E. Scott, Little Rock, succeeded M. Z. Bair, Little Rock, who has held post since the board was established in 1925.

The American Welding Society has elected the following officers for 1943-44: President, David Arnot, American Bureau of Shipping, New York, N. Y.; 1st vice president, Isaac Harter, vice president of the Babcock & Wilcox Co., Barberton, Ohio; 2nd vice president, A. C. Weigel, vice president Combustion Engineering Co., Inc., New York, N. Y.

Harry M. Olson, of Great Falls, Mont., has been elected president of the Pacific

CONSTRUCTION REPORTS

Compiled by Business News Department—Engineering News-Record, 330 W. 42nd St., New York

ELSIE EAVES, Manager *SCOTT McLEOD, Statistician*

(Daily service also available—Write for details)

WATER SUPPLY

PROPOSED WORK

Conn., Danbury—City, Mayor's Office, City Hall, changes West Lake and Marjorie Filter Plants, incl. new heating sys., $20,000.

†**Neb., Harvard**—Federal Works Agency, 20 N. Wacker Dr., Chicago, Ill., water and sewer project. $20,000.

†**Texas**—U. S. Eng., Fort Sam Houston, test well, Bell Co.

†**Tex., Cuero**—J. G. Bowman, mayor, City Hall, received no bids Nov. 5, brick, concrete pump house for WW imprvs., Tex. 41-610, FWA. Terrell Bartlett Engineers, Transit Tower Bldg., San Antonio, engrs. CD 10/26—ENR 10/28, under Sewerage, etc.

★**Tex., Dallas**—V. R. Smitham, city mgr., City Hall, bond election Dec. 28 (tentative date) WW imprvs. $1,000,000. Koch & Fowler, Great National Life Bldg., Myers & Noyes, Tower Petroleum Bldg., and Rollins & Forrest, Praetorian Bldg., engrs. CD 11/8—ENR 11/11.

★**Tex., Houston**—WW imprvs., San Jacinto mains, reservoir, etc. $1,869,500. Applied for FWA funds. Horner & Shifrin, Shell Bldg., St. Louis, Mo., engrs. CD 9/9—ENR 9/16.

†**Tex., Weatherford**—City, C. F. Russell, mayor, City Hall, WW imprvs. $23,500. **FWA.** Clarkson, Pelich, Geren & Rady, First National Bank Bldg., Fort Worth, engrs. CD 10/26—ENR 10/28.

Wash., Kettle Falls — Water sys. exten. $18,000.

BIDS ASKED

Bids Asked November 23

N. Y., St. George (Sta. Staten Island)—Comr. Water Supply, Gas & Electricity, Municipal Bldg., New York, Zone 7, hauling, laying watermains, appurtenances, Pacific and Overlook Aves., Guilford and King Sts., Beach Rd., Richmond Boro. Plans deposit $1.

Bids Asked November 29

Ore., Canby—Concrete well, present water sys. development. R. Mangus, City Hall, recdr.

LOW BIDDERS

†**O., Newton Falls** — Village, H. Spencer Hoak, clk., WW imprvs., Docket 33-903, from Bangl Eng. Co., 31 N. Summit St., Akron, $75,000, Est. $77,500. **FWA.** CD 6/9—ENR 6/17.

Wis., La Crosse—Bd. P. Wks., City Hall, Nov. 9, watermains in Losey Blvd. and Green Bay St., from P. DiPaolo, 6938 S. Paulina St., Chicago, Ill., **$21,253.** CD 11/3.

CONTRACTS AWARDED

†**Nebraska**—U. S. Eng., 1709 Jackson St., Omaha, well, Bux Butte Co., to C. & W. Contracting Co., Alliance, Est. under **$25,000.**

O., Wooster—City, well for water sys., to Holmes Constr. Co., Wooster, **$20,850.** Est. $20,000. Awarded 11/5. CD 7/8—ENR 7/15.

Tex., Dallas—City, water lines to W. G. Cullum Co., Great National Life Bldg., approx. $15,000. CD 8/7/42—ENR 8/31/42.

Que., Sorel—A. O. Cartier, city clk., reservoir, to L. Lochapelle, 75 George St., **$63,905.** J. Marchand, c/o owner, engr. CD 10/28—ENR 11/11.

SEWERS, WASTE DISPOSAL

PROPOSED WORK

†**Conn., Danbury**—Federal Correctional Institute, Danbury, drainage sys. Correctional Institute, Pembrooke Dist.

Kan., Kansas City—Sewage plant and sewers. $90,000. Applied for FWA funds. Wilson & Co., Salina, engrs.

Mich., Mt. Clemens—Macomb Co. Drain Comrs., Sewerage sys., approx. 33,000 ft. 6- to 18-in. sewers, appurtenances. H. R. O'Mara, 2220 National Bank Bldg., Detroit, engr.

O., Cincinnati—Bd. Comrs., Hamilton Co., installing storm sewers, imprv. section of road in Roselawn Dist. from Reading Rd. ¼ mi. east to Penn. R.R. $54,000. H. Coates, Cincinnati, co. engr.

★**Tex., Dallas**—V. R. Smitham, city mgr., City Hall, bond election Dec. 28, (tentative date), storm sewers, $1,500,000; sanitary sewers, $1,000,000. Myers & Noyes, Tower Petroleum Bldg., Rollins & Forrest, Praetorian Bldg., and Koch & Fowler, Great National Life Bldg., engrs. CD 11/8—ENR 11/11.

†**Tex., West University Place**—A. L. Kirbow, mayor, City Hall, sewer imprvs., Tex. 41-240, 231,644. **FWA.** Garrett Eng. Co., 3504 Audubon Ave., Houston, engrs.

†**Va., Portsmouth**—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., engineer-architect services by Consoer, Townsend & Quinlan, 211 W. Wacker Dr., Chicago, Ill., in connection with subsurface drainings, Norfolk Navy Yard, NOY 7994.

Que., Quebec City—Province of Quebec, c/o Ministry of Agriculture, Quebec City, drainage works. $258,000.

BIDS ASKED

Bids Asked November 26

†**Massachusetts**—U. S. Eng., 31 St. James Ave., Boston, sewer line, connection to Bldg. 6, Suffolk Co.

Bids Asked December 1

†**S. C., Hampton**—City, exten. sewerage sys. $35,000. **FWA.** Tomlinson Engineering Co., 1307 Marion St., Columbia, engrs.-archts. CD 10/18—ENR 10/21.

Bids Asked December 2

Mich., Flint—N. J. Vermilya, dir. Purchases & Supplies, City Hall, brick storm water pump. station with rein.-con. substructure for 2 vertical motor-driven sewage pump. units. Approx. $25,000. Plans deposit $10. Ayres, Lewis, Norris & May, 506 Wolverine Bldg., Ann Arbor, engrs.

LOW BIDDERS

Wis., Blair—M. Frederickson, city clk., City Hall, Nov. 1, sanitary sewers, from Standard Constr. Co., 2818 W. 3 St., Duluth, Minn., **$24,556.** CD 10/30.

CONTRACTS AWARDED

†**Maryland** — Fairchild Aircraft Corp., Hagerstown, sewage treatment plant, to Walker Bros., Chambersburg, Pa. Federally financed. Albert Kahn Assoc. Architects and Engineers, Inc., 345 New Center Bldg., Detroit, Mich., engrs.-archts. Bids 10/19.

★†**Maryland**—U. S. Eng., 1 and Douglas Sts. N.W., Wash., D. C., sewage disposal plant, utilities, Prince Georges Co., to Cummins Constr. Corp., 803 Cathedral St., Baltimore, **$625,000.**

†**Minnesota**—U. S. Eng., 1709 Jackson St., Omaha, Neb., remodeling, constructing addnl. facilities for sewage disposal plant, Contr. 25-066-eng-247, Ramsey Co., to Leck Constr. Co. 809 Metropolitan Bldg., Minneapolis, **$30,000.**

†**Tex., Cuero**—J. G. Bowman, mayor, City Hall, sanitary sewerage sys. imprvs., extens., Tex. 41-610, to Anderson & Waite, 1404 W. Martin St., San Antonio, **$35,379. FWA.** Bids 11/5. CD 10/26—ENR 10/28.

†**Va., Yorktown**—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., lateral sewers and house connections, Naval Mine Depot, NOY 7134, to Virginia Engineering Co., 330 28 St., Newport News, **$37,300.**

Location of ENR Correspondents

Symbols and Abbreviations Include:

† Federal Government
★ Project of $500,000 or over
ENR Engineering News-Record
CD Engineering News-Record Construction Daily
A-E-M Architect-Engineer-Management type of contract

Projects—By Size

Construction projects here reported cover the United States and Canada, are of these minimum sizes or larger: water supply, earthwork, waterworks, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

Classes of Construction

(Named in order of Listing)

Water Supply	Unclassified
Sewers, Waste Disposal	Latin America
Bridges	Public Buildings
Streets & Roads	Commercial Buildings
Earthwork, Waterways	Industrial Buildings

Stages Reported

PROPOSED: (except Streets & Roads):

BIDS ASKED (new announcements only. For full calendar, see also preceding issues of ENR);

LOW BIDDERS: On jobs below $500,000 value all low bidder news will be the final reports published on the projects involved except where award is not made to the low bidder. In this case, a supplementary contract award report will be published.

CONTRACTS AWARDED: Except awards to low bidders previously reported in low bidder stage.

Dates shown are of issue in which last previous report was published.

Note: To comply with censorship requirements, addresses on some reports are being generalized. Data which would reveal the purpose of the improvements and the size are withheld. The name of contractor and general area are reported.

BRIDGES

PROPOSED WORK

Mass., Chicopee—P. Wks. Dpt., City Hall, making plans steel, concrete bridge. Over $25,000. Tighe & Bond, 189 High St., Holyoke, engrs.

LOW BIDDERS

Texas—State Hy. Dpt., Austin, Nov. 12, widening structures on various creeks and branches, exten. small drainage structures between Sterret & Hill Co. line, Ellis Co., from Wallace & Bowden, 5513 E. Grand Ave., Dallas, **$68,511.**

CONTRACTS AWARDED

New Mexico—State Hy. Dpt., Santa Fe, grading, addnl. drainage and gravel surfacing 23.9 mi. S.R. 53, between Grants and the Navajo Fluorspar Mine, DA-RM 66, Valencia Co., to Floyd Haake, 1201 Sierra Vista, Santa Fe, **$74,304**; grading, minor drainage structures, repairing, strengthening existing timber bridges, surfacing and oil processing 9.00I mi. S.R. 30 between Espanola and Otowi, DA-WR 53-C(1), Santa Fe and Rio Arriba Counties, to Martin & Cowart, Ft. Sumner, **$87,731.** Bids 11/13.

Que., Bromptonville—Municipality, c/o J. A. Ouellette, clk., 70 ft. rein.-con. bridge over Key River, to Savard-Lefebvre & Tessier, 7 Notre Dame St., Ste. Anne de la Perade, Est. **$25,000.** O. Desjardines, Dpt. P. Wks., Quebec City, engr.

Que., La Patrie—Municipality of Ditton, c/o E. Jette, clk., La Patrie, 2 rein.-con. bridges over River Aux Sallmons, to Boisvert & Gelinas, 60 5 St., Shawinigan Falls. CD 9/23—ENR 9/30.

STREETS AND ROADS

BIDS ASKED

Bids Asked November 23

South Carolina—J. S. Williamson, ch. comr. State Hy. Dpt., Columbia, bituminous surfacing 2.723 mi. S. C. Docket 40. 290—Defense Access Proj. DA-WC21A, Route 769, Richland Co.; 2.768 mi. Route 24, S. C. Docket 4.259—Defense Access Proj. DA-WC20A, Anderson Co. C. R. McMillan, state hy. engr.

Bids Asked November 24

Nebraska—State Dpt. Rd. & Irrigation, W. G. Scott, state engr., Lincoln, grading, concrete box culvert, State Rd. 286-c, Bristow-Lynch; sand gravel surfacing State Rd. Patrol 21008 and 21043, Ulysses-Valparaiso.

Bids Asked November 30

Kansas—State Hy. Dpt., Garnet, resurfacing material 20.82 mi. Proj. 46939-B; 7.040 mi. Proj. 4694; 10.588 mi. Proj. 4695, all foregoing Anderson Co.; 2.464 mi. Proj. 4696, and 12.42 mi. Proj. 4697, Bourbon Co.; 4.855 mi. Proj. 4698; 10.274 mi. Proj. 4699, both Coffey Co.; 10.98 mi. Proj. 4700 AB, Crawford Co.; 6.767 mi. Proj. 4701; 3.162 mi. Proj. 4702; 2.405 mi. Proj. 4703, all foregoing Franklin Co.; 14.145 mi. Proj. 4704 AB; 7.572 mi. Proj. 4705, both Miami Co.; 2.97 mi. Proj. 4706, Neosho Co. R. C. Keeling, Topeka, engr.

LOW BIDDERS

Colorado—State Hy. Dpt., Denver, Nov. 5, imprv. 35.1 mi., and bridge work, Mesa Co., from Brown Constr. Co., Colorado Springs, **$115,448.** CD 10/25—ENR 10/28.

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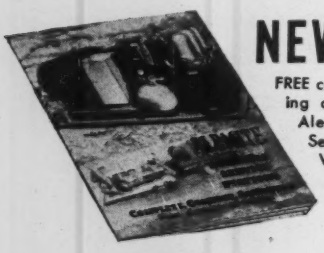

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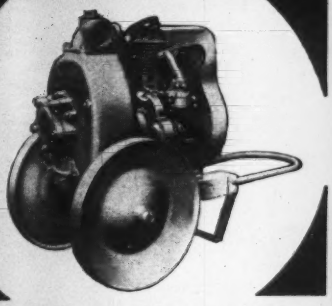

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STREETS, etc. (Low Bidders, Cont'd.)

Kentucky—State Hy. Dpt., Frankfort, grading, drainage, surfacing 2.15 mi. Harrisonville-Lawrenceburg Rd., SP 106-286, Shelby Co., from Lyons & Breedon, Rogersville, Tenn., **$29,784.**

N. Y., New York—President Bronx Boro, Bronx County Bldg., 851 Grand Concourse, Nov. 4, imprv. E. 145 St., from Venetian Contracting Co. Inc., Bareto St. and Ryawa Ave., **$31,696;** Eastern Blvd., from C. D. Beckwith, Seneca Ave. and Edgewater Rd., **$59,162.** CD 10/26—ENR 10/28.

Ohio—State Hy. Dpt., Columbus, Nov. 9, imprv. 0.735 mi. Greene Co., from Hinton & Smalley, Celina, **$99,012.** Est. $101,000. CD 11/3.

Texas—State Hy. Comn., Austin, Nov. 12, imprv. 4.455 mi. Cameron Co., from Dodds & Wedegartner, Inc., San Benito, **$100,045***** 4.356 mi. Orange Co., from Harrison Engr. & Constr. Corp., 4638 Mill Creek Pkwy., Kansas City, Mo., **$58,492*****13.594 mi. Coryell Co., from H. Campbell, 2425 Winton Terrace, Fort Worth, **$155,304.** CD 11/3.

West Virginia—State Hy. Dpt., Charleston, imprv. 0.468 mi. Kanawha Co., from I. V. Cunningham, Charleston, **$59,093;** 3.1 mi. Mason Co., from L. C. Hanna, Charleston, **$47,439.** CD 11/4.

CONTRACTS AWARDED

†**California**—U. S. Eng., 751 S. Figueroa St., Los Angeles, roads, Contr. 04-353-eng-60, Santa Barbara Co., to C. G. Willis & Sons, 2119 E. 25 St., Los Angeles, **$80,000.**

†**Calif., Port Chicago**—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., repairs and resurfacing roads, Naval Magazine, NOY 7768, to Piazza & Huntley, 175 S. Montgomery St., San Jose, **$85,181.**

Idaho—Dpt. P. Wks., Bureau of Hys., Boise, crushed rock resurfacing 3.806 mi. Moscow-Boville Hy. between Deary and Helmer and placing crushed rock in stockpiles, SAP 91-C(2) D(2), Latah Co., to F. H. DeAtley, Lewiston, **$41,690.** Bids 11/5.

†**Kansas**—U. S. Eng., 10 E. 17 St., Kansas City, Mo., grading, constr. pavement, training aids, etc., Contr. 23-028-eng-154, Pratt Co., to List & Clark Constr. Co., Railway Exchange Bldg., Kansas City, Mo., **$40,000.**

†**Kentucky**—U. S. Eng., 612 Federal Bldg., Louisville, road surfacing, Contr. 15-029-Eng-315, Jefferson Co., to R. B. Tyler, 1446 Levering St., Louisville, **$60,000.**

†**Maryland**—U. S. Eng., Standard Oil Bldg., Baltimore, access road, drainage facilities, testing slab, Contr. 18-020-Eng-150, Harford Co., to C. J. Langefelder & Son, Rosedale, **$70,000.**

†**New Jersey**—U. S. Eng., 120 Wall St., New York, 5, N. Y., paving roads, Essex Co., to Santaniello Bros., 34 Whyte St., Jersey City, **$25,000.**

Oregon—State Hy. Comm., Salem, Nov. 8, imprv. 13,400 sq. yd. Curry Co., to R. O. Dail & Warren Bros., 8919 SE Foster St., Portland, **$41,000;** 2,600 yd. Baker-Malheur Co., to Western Rock Co., Salem, **$77,410.** Bids 11/8. Rejected bids 11/8, imprv. 14,800 yd. Malheur Co. CD 10/29.

Pa., Baden—Baden Boro, W. Ross Rea, secy., Municipal Bldg., grading, draining, curbing, concrete paving, to Allegheny Constr. Co., 5816 Walnut St., Pittsburgh, **$30,041.** CD 11/3.

Pa., Pittsburgh—F. M. Roessing, dir. Dpt. P. Wks., City-County Bldg., resurfacing streets, Contr. 2, to Allegheny Asphalt & Paving Co., 411 Blvd. of Allies, **$83,956.** Est. $100,000. CD 10/22.

†**Texas**—U. S. Eng., Fort Sam Houston, widening, repairing, exten. road, Contr. 41-154-eng-81, Bexar Co., to R. W. Briggs & Co., and M. B. Killian, Sunset Rd., San Antonio, **$40,000.**

†**Texas**—U. S. Eng., 416 Wright Bldg., Tulsa, 2, Okla., paving, Dallam Co., to W. G. Walton & Co., 506 National Reserve Bldg., Topeka, Kan., approx. **$25,000.**

Ontario—Dominion Govt., Ministry Munitions & Supply, Ottawa, road construction, Meaford, to Sterling Constr. Co. Ltd., 2494 E. Sandwich St., Windsor, **$94,000.** Dpt. Natl. Defense, Ottawa, Ont., engrs.

Ont., Kitchener—Pannill Veneer Co., Ltd., 42 Edward St., constructing bush roads, grading and part graveling, to F. A. Barkley, 851 Coxwell Ave., Toronto. Est. **$30,000.**

Ont., Medford—Dpt. National Defense (Army), Ottawa, road imprvs., at A. F. V. Range, to Sterling Constr. Ltd., 2494 Sandwich St. E., Windsor, **$94,000.**

EARTHWORK, WATERWAYS

PROPOSED WORK

†**Massachusetts**—U. S. Eng., 819 Industrial Trust Bldg., Providence, R. I., rejected bids Oct. 11, dredging maintenance projects, No. 44/35, Bristol Co. CD 10/1—ENR 10/7.

†**Oklahoma**—U. S. Eng., 416 Wright Bldg., Tulsa, Zone 2, levee work, left bank, Sect. B, Arkansas River, Sol. No. 34-066-44-20, Tulsa Co. Over $15,000.

†**Ore., Bend**—Reclamation Bureau, Denver, Colo., plans resumption of Deschutes reclamation project, developing 20,000 acres, constructing 12 mi. canal, excav., lining two 3,400 ft. tunnels, and wooden flume over Crooked River, fish screen at Wickup Dam.

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EARTHWORK & WATERWAYS (Cont'd.)

BIDS ASKED

Bids Asked November

Ont., Sault St. Marie — Actg. Secy., Dpt. Transport, Ottawa, walls at lower gates of lock on Sault Ste. Marie Canal. About $50,000. Plans deposit $10.

†California—H. W. Bashore, Constr. Engr., Bureau of Reclamation, Friant, earthwork and structures, Station 1050 plus 75 to Station 1828 plus 90, Madera Canal, Friant Div., Central Valley Proj., Spec. 1061.

LOW BIDDERS

†Washington—Bureau of Reclamation, Denver, Colo., Nov. 8, earthwork, pipelines, structures, laterals, sub-laterals, diversion channels between Mile 38.17 and Mile 49, Roza Div., Yakima Project, Spec. 1062, from Macri & Co., 905 10 Ave. S., Seattle, **$132,200**. CD 10/28—ENR 10/28.

†Texas—U. S. Eng., 25 St. and Avenue F, Galveston, Intracoastal Canal dredging, No. 161, Brazoria and Matagorda Counties, from Hendry Corp., Rattlesnake, Fla., approx. **$200,000.**

CONTRACTS AWARDED

†Arkansas—U. S. Eng., 300 Byway, Little Rock, bank protection dikes along bank of Arkansas River, Pulaski Co., to Massman Constr. Co., 737 N. Y. Life Bldg., Kansas City, Mo., **$72,000.** Awarded 11/5.

†Connecticut—U. S. Eng., Industrial Trust Bldg., Providence, R. I., dredging, maintenance work, No. 44-19, Fairfield Co., to Lavigne & Smith, Inc., 18 Taunton Ave., East Providence, R. I., and J. S. Packard Dredging Co., 1 Court St., Boston, Mass., Est. **$50,000-$100,000.** Bids 9/4. CD 8/26.

La., Shreveport—Bd. Comrs. Caddo Levee Bd., Shreveport, constructing Simpson Lake Levee, to E. L. Miller, Bossier City, **$15,000.**

†N. D., Minot—Bureau Reclamation, Interior Bldg., 19 and C Sts. N.W., Wash., D. C., repairing Lake Darling Dam, to R. S. Billingsley Co., 2517 Nicollet Ave., Minneapolis, Minn., **$80,000.**

†Oregon—U. S. Eng., 628 Pittock Blk., SW 10 Ave. and Washington St., Portland, flood control construction, pile dike extens., levee repairs, revetment and toe piling, Clatsop Co., to Gilpin Constr. Co., 4854 N.W. Front St., Portland, **$47,000.** CD 10/6—ENR 10/14.

†Rhode Island—U. S. Eng., 819 Industrial Bldg., Providence, maintenance dredging, No. 44/15, to J. S. Packard Dredging Co., 1 Court St., Boston, Mass. Est. under **$50,000.** Bids 8/28. CD 8/19.

N. B., Saint Johns—Dpt. P. Wks., Ottawa, Ont., dredging in Courtney Bay, to Marine Industries, Ltd., 1405 Peel St., Montreal, Que., **$280,255.** CD 8/27.

UNCLASSIFIED

PROPOSED WORK

Calif., Richmond — RAILROAD TRACK—Permanente Metal Corp., railroad track and relocation existing track at Shipyard 2.

†Colorado—IMPROVEMENTS—U. S. Eng., 909 17 St., Denver, imprvs., bldgs., El Paso Co. Over $200,000.

★**†Florida** — CONSTRUCTION — U. S. Eng., 575 Riverside Ave., Jacksonville, Zone 2, construction at an Army Air Forces installation, Highland Co. $1,000,000.

Kansas—OIL WELL—Bridgeport Oil Co., Colcord Bldg., Tulsa, Okla., drilling, casing, developing 8,000 ft. test oil well, Graham Co. Over $25,000.

Louisiana—CABLES—Shell Oil Co., Lake Charles, installing, maintaining 2 cables for supporting existing downstream cluster at loading terminal in Mississippi River, right descending bank, approx. Sta. 495-00 of west bank levee survey, near La Pice, 184.74 mi. above mouth of Southwest Pass, Mississippi River, St. James Parish.

Louisiana—OIL WELL—Continental Oil Co., Oil & Gas Bldg., Houston, Tex., drilling, developing 8,000 ft. test oil well, earthen storage, etc., Cameron Parish. Over $25,000.

Louisiana—OIL WELL—Magnolia Petroleum Co., Magnolia Bldg., Dallas, Tex., 12,000 ft. test oil well, earthen storage, fuel line, etc., Beauregard Parish. Over $25,000.

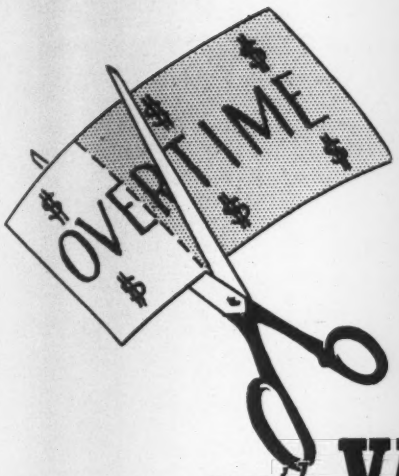
Louisiana—OIL WELL—R. Y. Walker, et al, Lake Charles, drilling, casing, developing 9,000 ft. test oil well, earthen pits, etc., Ascension Parish. Over $25,000.

Mass., East Boston (sta. Boston)—AIRPORT EXTENSION—Dpt. P. Wks., Commonwealth of Massachusetts, 100 Nashua St., Boston, new plans airport exten. E. N. Hutchins, 100 Nashua St., Boston, engr. CD 11/3—ENR 11/11.

Mo., Columbia—AIRPORT—City, airport expansion. $300,000. Applied for CAA funds.

Mo., Sedalia—AIRPORT—City voted $55,000 bonds, airport construction and development, incl. runways, lighting sys., drainage, etc., on site 6 mi. northwest of here. Over $100,000. CD 10/20—ENR 10/28.

★**Montana**—OIL PIPELINE—Yale Oil Pipe Line Co., Denver, colo., 8 2/10 mi. 6 and 8 in. oil pipeline from the Elk Basin and Frannie Fields to refineries in Laurel and Billings, approx. $830,000.



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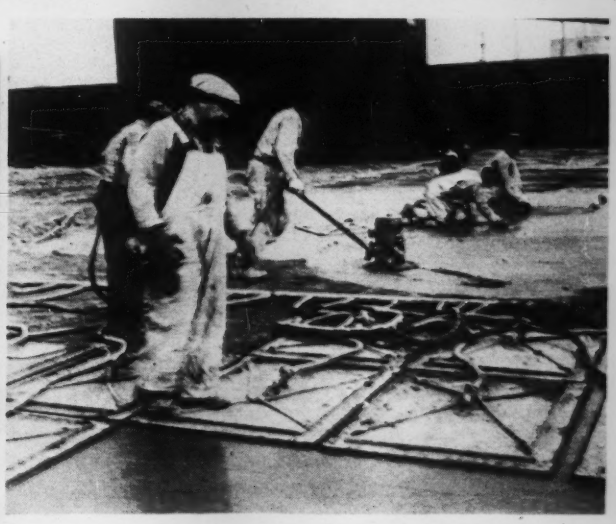

Laborer is standing on VACUUM-dewatered concrete. Note the finisher is bull-floating freshly placed concrete directly in front of Vacuum suction mats.

Nothing to buy—Truck mounted Vacuum pump carrying complete processing equipment is furnished on rental basis. Services of Supervisor to train and direct your men in handling of equipment furnished at no extra cost.

Cement finishers power-floating and trowelling VACUUM-dewatered concrete *immediately behind* VACUUM suction mats. No waiting hours for water to disappear from slab; no dust coat application—just VACUUM-process and start finishing. You can concrete until five o'clock and send the finishing crew home at 7 P.M., instead of Midnight or 3 A.M.

Send coupon at right for money saving information →

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Cracked DIESEL CYLINDER HEADS MADE EQUAL TO NEW

STARK 10-POINT RECONDITIONING PROCESS

EXAMINATION All parts removed, head thoroughly examined.

PREPARATION Old, burned metal around all valve seats removed. Head prepared for uninterrupted welding in preheating oven.

PREHEATING Head preheated in temperature controlled oven of special Stark design. All cracks become visible.

WELDING Cracks acetylene - welded by specialists working exclusively on heads.

VALVE SEATS All built-up with hard alloy wear-resisting metal.

TESTING Hydrostatic test makes sure no cracks are overlooked.

RESURFACING All surfaces of head ground (not machined) to factory finish.

MACHINING Built-up valve seats machined with production cutters. All other machining to original specifications.

GRINDING New valve guides installed; seats precision ground for perfect seating.

INSPECTION & ASSEMBLY All parts replaced; head checked for immediate use.

IT PAYS TO DO IT RIGHT THE FIRST TIME

Make-shift or temporary cylinder head repairs are costly in time lost, extra mechanical work, etc.

By having your cracked cylinder heads reconditioned by the Stark 10-point process you are sure that when they go into service, you will get the same results as a new head.

RALPH STARK INC.
SPECIALIZED RECONDITIONING
43-12 Thirty-third St.
Long Island City, N. Y.

UNCLASSIFIED (Proposed Work—Cont'd)

†**Nebraska**—IMPROVEMENTS—U. S. Eng., 1709 Jackson St., Omaha, improvs., grading, etc., Thayer Co. $300,000.

†**Texas**—IMPROVEMENTS—U. S. Eng., Fort Sam Houston, imprvs., gas chambers, Bexar Co.

Texas—OIL CAMP—Humble Oil & Refining Co., Humble Bldg., Houston, oil camp, inst. roads to 10 oil well drilling sites, water facilities, sanitary sewers, lighting, storage facilities for wells, etc. Over $25,000.

Texas—OIL WELL, etc.—Sterling Oil & Refining Corp., Sterling Bldg., Houston, drilling, casing, developing new 7,000 ft. test oil well, storage, Hardin Co. Silver Lake area. Over $25,000.

Texas—OIL WELL—Ungren & Frazier, West Central Texas Drilling Co. and Maracaibo Oil & Exploration Co., Anson, drilling, casing, developing new 8,000 ft. test oil well, storage facilities, Stith community, Jones Co. Over $25,000.

†**Texas**—IMPROVEMENTS—U. S. Eng., 410 Wright Bldg., Tulsa, 2, Okla., imprvs., bldgs., Sol. 34-006-44-22, Dallam Co.

†**Texas**—IMPROVEMENTS—U. S. Eng., Fort Sam Houston, imprvs., Bexar Co. Over $25,000.

†**Texas**—IMPROVEMENTS—U. S. Eng., Fort Sam Houston, imprvs., parking ramps, Bexar Co.

†**Texas**—IMPROVEMENTS—U. S. Eng., 25 St. and Ave. F, Galveston, imprvs., bldgs., Sol. 41-243-44-C82, McLennan Co.

Tex., Floydada—OIL WELL, etc.—Pure Oil Co., Esperson Bldg., Houston, developing new $5,500 ft. test oil well, storage, $25,000.

Tex., Hunt—FENCING, LAKE, etc.—G. H. McCarthy, Sterling Bldg., Houston, developing 250 acre tract, fencing, lake, game preserve grounds development, etc. Over $25,000.

Tex., Liberty—CRUDE OIL FLOW STORAGE FACILITIES—Wm. Helis, Commerce Bldg., Houston, crude oil flow storage facilities. Over $40,000.

Tex., Novice—OIL WELL—Auto Ordnance Corp., Standard Oil Co. of Ohio, Esperson Bldg., Houston, drilling, developing new 3,850 ft. oil well.

Tex., Richmond—OIL WELL—H. M. Naylor Oil Co., Second National Bank Bldg., Houston, drilling, developing another deep test oil well, ground storage, fuel line.

Tex., Roma—OIL WELL—Circle Oil Co., Commerce Bldg., Houston, drilling, developing new 4,000 ft. test oil well. $25,000

★**Ont., Toronto**—SAFETY ZONES—Toronto Transportation Comn., 35 Yonge St., 43 safety zones, at street intersections. $750,000.

BIDS ASKED

Bids Asked November 24

★†**S. C., Camden**—AIRPORT—Civil Aeronautics Admin., 84 Marietta St., Atlanta, Ga., airport. $1,500,000. CD 7/13—ENR 7/15.

Bids Asked

†**New Hampshire**—CLEARING—U. S. Eng., 31 St. James Ave., Boston, Mass., (selected list bidders), clearing area, No. 19-023-44-NEG 110, Hillsboro Co.

Bids Asked November 25

Ont., Mountain View (Hamilton)—HANGAR, etc.—Secy. Dpt. Munitions & Supply, Ottawa, hangar accomodation addn. at No. 6 Bombing and Gunnery School, for Dpt. Natl. Defense (Air), Ottawa, Ont. About $75,000.

Bids Asked November 29

B. C., Vancouver—HANGAR, etc.—Secy. Dpt. Munitions & Supply, Ottawa, Ont., addnl. hangar accomodation at E. F. T. school, incl. 1 double seaplane hangar, for Dpt. Natl. Defense (Air), Ottawa, Ont. $150,000.

Bids Asked

†**Maine**—CONSTRUCTION—U. S. Eng., 31 St. James Ave., Boston, Mass., (selected list bidders), concrete structure, No. 19-023-44-Neg 117. $5,000.

LOW BIDDERS

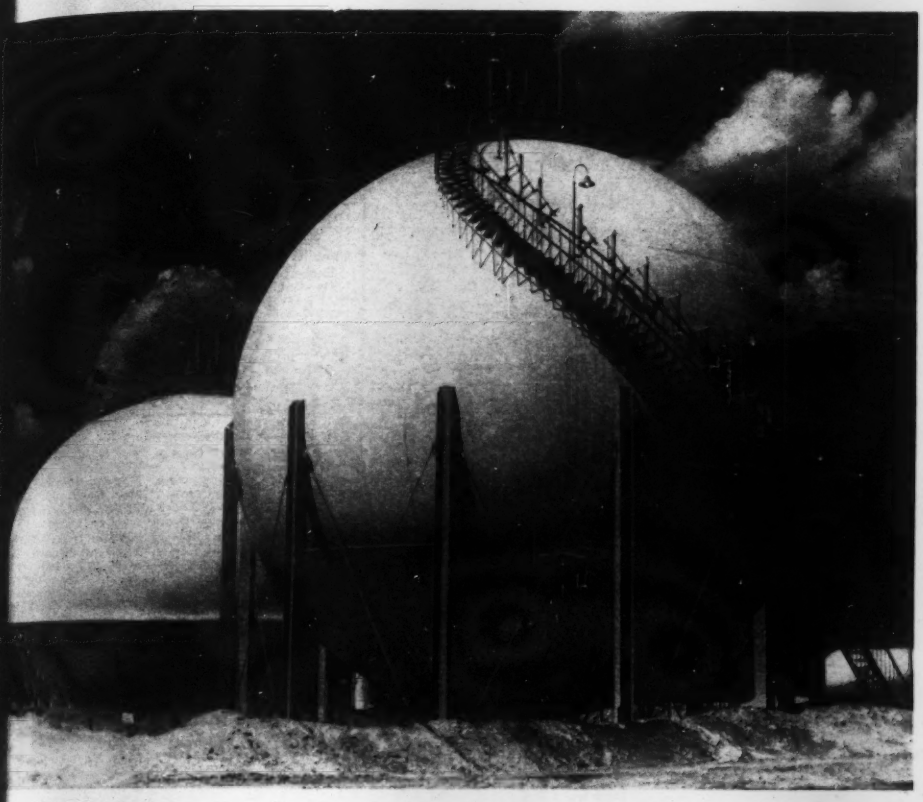
†**Louisiana**—IMPROVEMENTS—U. S. Eng., 25 St. and Avenue F, Galveston, Tex., Nov. 1 imprvs., Sol. No. 41-243-44-C72, Beauregard Parish, from W. R. Aldrich & Co., P. O. Box 272, Leesville, approx. $50,000.

CONTRACTS AWARDED

†**Arkansas**—IMPROVEMENTS—U. S. Eng., 300 Bway., Little Rock, imprvs., night lighting facilities, Arkansas Co., to I. K. Electric Co., 311 Main St., Little Rock, $50,000. Awarded 11/8.

†**California** — APRONS, WARM-UP PADS, etc.—U. S. Eng., 751 S. Figueroa St., Los Angeles, Zone 14, aprons, warm-up pads, roads and walks, Contr. 04-353-Eng-59, Kern Co., to O'Neal & Hedberg, 852 S. Robertson Blvd., Los Angeles, $100,000.

†**California**—TRAINING FACILITIES—U. S. Eng., 751 S. Figueroa St., Los Angeles, Zone 14, addnl. training facilities, Contr. 04-353-Eng-39, Kern Co., to J. F. Cummins, Burbank, $70,000.



This view shows a 15,000-bbl. Hortonspheroid and a 15,000-bbl. Hortonsphere for the storage of Butane at the Plains Butadiene plant.

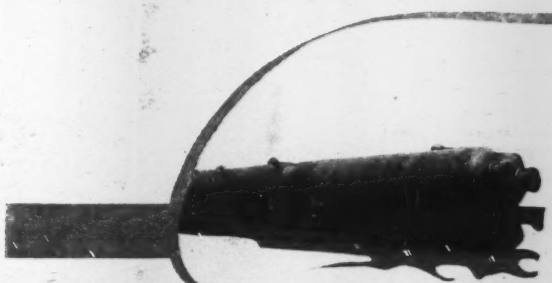
...storage for the ingredients of SYNTHETIC RUBBER

Butadiene is one of the principal ingredients of synthetic rubber. It is a light volatile liquid that must be stored under pressure to prevent excessive evaporation loss. Hortonspheres like the one pictured above provide an economical means of storing it under pressure.

Butane is one of the principal ingredients of Butadiene. It also is a light volatile liquid and must be stored under pressure to prevent excessive losses from evaporation. Hortonspheres or Hortonspheroids like the one shown in the left background of the above view are used to store Butane, depending upon the pressure required.

Hortonspheres are built in capacities of 1,000 to 20,000 bbls. for pressures from 20 to 100 lbs. per sq. in. Hortonspheroids are built in standard capacities ranging from 2,500 to 40,000 bbls. for pressures from 2½ to 35 lbs. per sq. in. and as large as 120,000 bbls. for pressures from 2½ to 20 lbs. per sq. in.

. . . . Awarded to our shipyard at Seneca, Ill. and dry dock yards at Eureka, Calif. and Newburgh, N. Y.



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are also used in the production of synthetic rubber. These were fabricated at our Birmingham plant for use in making butyl rubber.

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...eland 15	2201 Guildhall Bldg.	Birmingham 1	1520 North Fiftieth Street	San Francisco 5	1020 Rialto Bldg.

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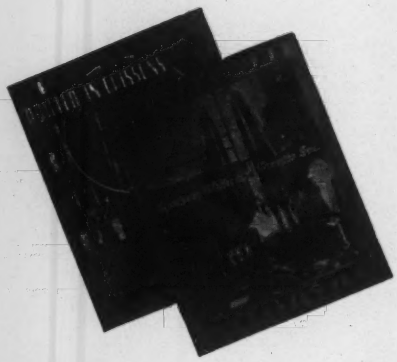

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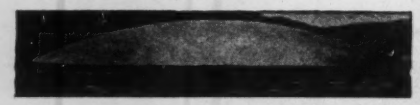

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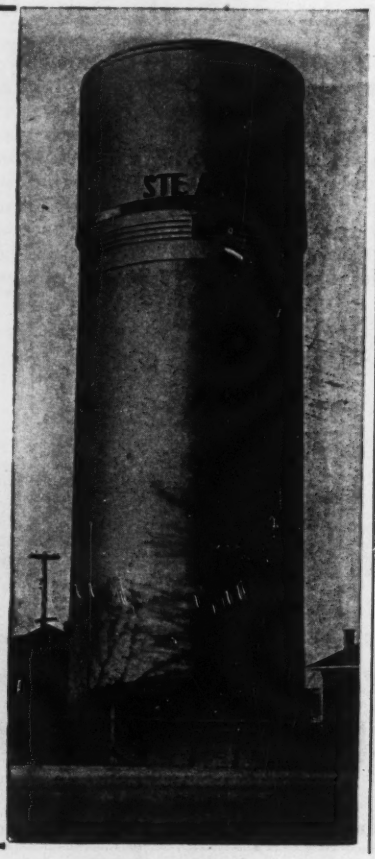


UNCLASSIFIED (Contracts Awarded, Cont'd.)

†California — CONSTRUCTION, etc.—U. S. Eng., 751 S. Figueroa St., Los Angeles, addl. constr., utilities, paving, Contr. 04-353, eng-7[illegible] Kern Co., to A. Reingardt, Long Beach, $[illegible],000.

†Calif., San Diego—PARKING AREA—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N. W., Wash., D. C., addnl. parking area for landing craft, Destroyer Base, NOY 77[illegible] to V. K. Dennis, P. O. Box F, Station A, San Diego, **$69,400.**

†Calif., San Diego—STORAGE FACILITIES—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., addnl. storage facilities, Destroyer Base, NOY 7282, to L. C. Anderson Co., 414 Bway. Bldg., **$66,990.**

Conn., Hartford—LOADING PLATFORMS—New York, New Haven & Hartford R. R. Co., E. E. Oviatt, ch. engr., Water St., New Haven, renewal timber loading platforms, Morgan St., to O. F. Burghart, Inc., 155 Island Brook Ave., Bridgeport. Est. **$30,000.** CD 9/2[illegible] ENR 9/30.

†Florida—TAXIWAYS, DRAINAGE, etc.—U. S. Eng., 575 Riverside Ave., Jacksonville, Zone 2, taxiways, drainage, and hardstands, Neg-Jax-44-303, Hillsborough Co., to H. [illegible] Wolfe Constr. Co., St. Augustine, approx. **$50,000.** Awarded 10/30.

†Florida—PARKING APRONS—U. S. Eng., 575 Riverside Ave., Jacksonville, Zone [illegible] addnl. parking aprons, Neg-Jax-44-320, Sarasota Co., to Brinson, Cone & Manly, Casey and Cumberland Rd., Tampa, Zone I, approx. **$40,000.** Awarded 11/9.

†Fla., Jacksonville—WARM-UP PLATFORM and PARKING AREA—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., addnl. concrete warm-up platform and parking area for VPB operational training units, Naval Air Station, NOY 741[illegible] to Ivy, H. Smith Co., P. O. Box 5098, **$89,[illegible]**

†Idaho—CONSTRUCTION—U. S. Eng., [illegible] Pittock Blk., SW. 10 Ave. and Washington St., Portland, Ore., heavy construction, Ada Co., to J. Nottingham, 329 Grove St., Boise, **$27,000.** Awarded 11/12.

†Idaho—FACILITIES—U. S. Eng., 628 Pittock Blk., SW. 10 Ave. and Washington St., Portland, Ore., addnl. facilities, Contr. [illegible] 026-eng-336, Ada Co., to H. J. McNeel, Caldwell, **$60,000.**

†Indiana—CONSTRUCTION— U. S. Eng., 612 Federal Bldg., Louisville, Ky., addnl. construction, Contr. 15-029-eng-313, Allen Co., to Hagerman Constr. Co., 402 E. Superior St., Fort Wayne, **$100,000.**

†Iowa—IMPROVEMENTS—U. S. Eng., [illegible] Jackson St., Omaha, Neb., imprvs., Woodbury Co., to C. Hansen, 3822 Ridge Ave., Sioux City, under **$50,000.**

†Kansas—IMPROVEMENTS—U. S. Eng., [illegible] E. 17 St., Kansas City, Mo., imprvs., night lighting sys., Pratt Co., to Bradley-Dodson-Grafentin, 210 S. 12 St., Omaha, Neb. Est. **$42,000.**

†Kansas—IMPROVEMENTS—U. S. Eng., [illegible] E. 17 St., Kansas City, Mo., imprvs., night lighting sys., Cowley Co., to Bradley-Dodson-Grafentin, 210 S. 12 St., Omaha, Neb. Est. **$40,000.**

†Kansas—IMPROVEMENTS—U. S. Eng., [illegible] E. 17 St., Kansas City, Mo., imprvs., night lighting sys., Ellis Co., to Alber Elec. Co., [illegible] E. 55 St., Kansas City, Mo. Est. **$38,000.**

†Kansas—IMPROVEMENTS—U. S. Eng., [illegible] E. 17 St., Kansas City, Mo., imprvs., night lighting sys., Montgomery Co., to Bradley-Dodson-Grafentin, 210 S. 12 St., Omaha, Neb. Est. **$38,000.**

†Louisiana—NIGHT LIGHTING SYSTEM—U. S. Eng., 300 Bway., Little Rock, Ark., addnl. night lighting facilitties, Contr. [illegible] eng-61, Caddo Parish, to T. B. Merrill, Winnsboro, **$30,000.**

†Louisiana—STORAGE FACILITIES—U. S. Eng., 300 Bway., Little Rock, Ark., storage facilities, Contr. 03-050-eng-74, Caddo Parish, to Werner Co., 1320 Pierre Ave., Shreveport, **$30,000.**

†Louisiana—IMPROVEMENTS—U. S. Eng., [illegible] 25 St. and Avenue F, Galveston, Tex., improved erosion control work, consisting of excav., [illegible] soiling, sodding, asphalt surfacing, seeding, fertilizing, concrete pipe, Sol. No. 41-32-[illegible] C73, Lafayette Parish, to W. R. Aldrich & Co., P. O. Box 272, Leesville, approx. **$25,000.** Bids 11/6.

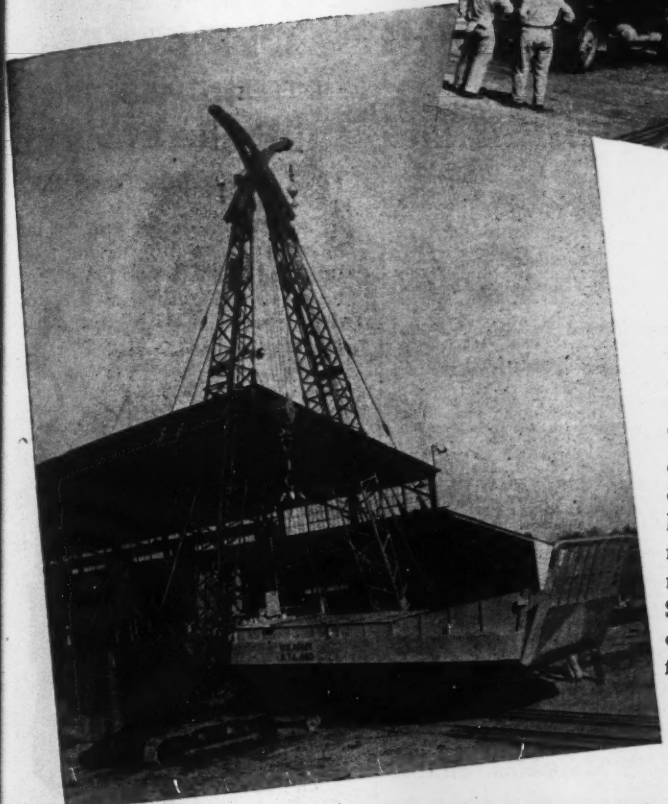
†Louisiana—IMPROVEMENTS—U. S. Eng., [illegible] 300 Bway., Little Rock, Ark., imprvs., bitulithic wash rack, etc., Sol. No. 03-050-44-17, Rapides Parish, to Tudor & Ratcliff, Alexandria, approx. **$30,000.** Bids 11/1.

†Massachusetts—DISTRIBUTION SYSTEM—U. S. Eng., 819 Industrial Trust Bldg., Providence, R. I., distr. sys. exten., No. 46[illegible] Hampden Co., to E. J. Pinney Co., Inc., [illegible] Dwight St., Springfield. Est. under **$[illegible]** CD 11/9—ENR 11/11.

†Michigan—AIR FREIGHT TERMINAL—U. S. Eng., 700 Union Guardian Bldg., Detroit, 31, air freight terminal bldg. addn., Wayne Co., to Haberkorn-Barry Co., 719 Boulevard Bldg., Detroit.

Minn., Hibbing—HANGAR—Village, C. Aura, clk., 120x160 ft. concrete block hangar, to R. J. Ryan, Ryan Lumber & Coal Co., Hibbing, probably over **$25,000.** L. [illegible] lar Flying School, Hibbing, lessee.

BOOMS for HEAVY LIFTS



Strong, sturdy booms have always been associated with BAY CITY equipment. Here we show two war-time applications. Top photo illustrates 85 foot boom on two CraneMobiles setting a 50-ton crane, and lower photo shows two crawler cranes handling a Landing Barge on 45 foot booms. These booms are of the pin-connected type, all electric welded of lattice section and strongly cross-braced. The use of alloy steels in both boom and jib makes it possible to get longer reach and greater capacity in pay-loads. Right now, these cranes are going *only* to the Armed Services. We will, however, be glad to send you catalogs so you will have complete data when figuring your post-war requirements.

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12 Sizes
⅜ to 1½ Yard
Also truck mounted shovels and cranes

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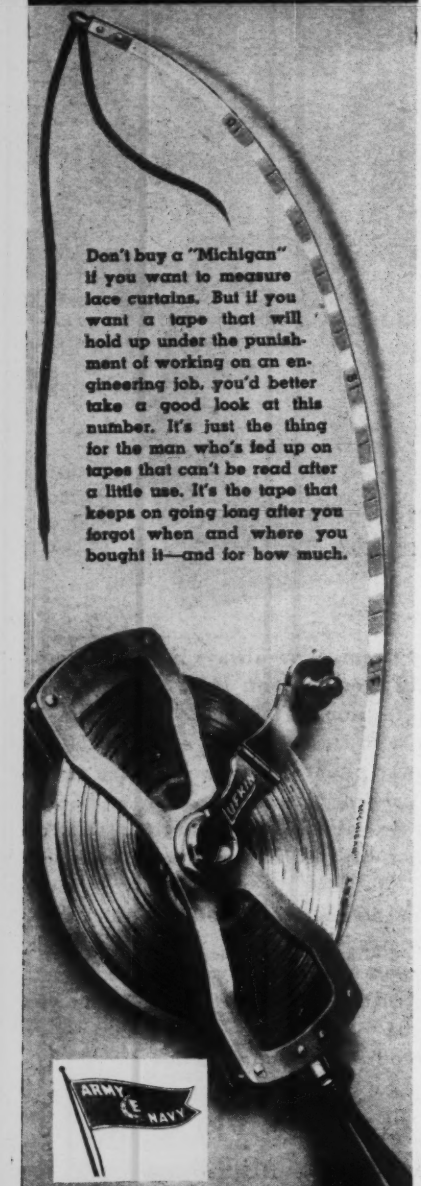

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TAPES · RULES · PRECISION TOOLS

UNCLASSIFIED (Contracts Awarded, Cont'd.)

†**Minn., Minneapolis** — EXPERIMENTAL HANGAR, etc.—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., experimental hangar and building, and services, NAS, Wold-Chamberlain Field, NOY 7477, to Standard Constr. Co., Inc., 604 National Bldg., **$342,700.**

†**Nebraska**—IMPROVEMENTS—U. S. Eng., 1709 Jackson St., Omaha, imprvs., loading dock, bldg., Sarpy Co., to Parsons Const. Co., Grain Exchange Bldg., Omaha. Est. under **$50,000.**

†**Nebraska**—NIGHT LIGHTING SYSTEM—U. S. Eng., 1709 Jackson St., Omaha, night lighting sys., Contr. 25-066-eng-251, Scottsbluff Co., to Scotty Electrical Works, Inc., Greeley, Colo., **$30,000.**

†**New Mexico**—GRADING, etc.—U. S. Eng., 4 and Gold Sts., Albuquerque, grading, Schedules 1 and 2, No. 44-599, Lea Co., to Plains Constr. Co., Pampa, Tex., **$65,968.**

†**New Mexico** — IMPROVEMENTS — U. S. Eng., Albuquerque, imprvs., surfacing, Curry Co., to Peter Kiewit Sons Co., Omaha Natl. Bank Bldg., Omaha, Neb. Est. under **$50,000.**

★†**New York**—TRANSIT FACILITIES, etc. —Bd. Transportation, 250 Hudson St., New York, changing transit facilities, imprv. Brooklyn Bridge and approaches, Manhattan and Brooklyn Boros, to E. W. Foley, Inc., 16 Court St., Brooklyn, **$699,286.** Bids 9/21. CD 9/24—ENR 9/30 under LB.

†**Ohio**—ELECTRICAL WORK, etc.—U. S. Eng., Chesapeake & Ohio Bldg., Huntington, W. Va., electrical work, electrical distr. sys., Contr. 46-022-eng-34, Muskingum Co., to Lawrence Electric Co., Zanesville, **$30,000.**

†**Ohio**—FLIGHT OPERATIONS BLDG., etc. —U. S. Eng., 700 Union Guardian Bldg., Detroit, 31, Mich., flight operations bldg. and fire house, Cuyahoga Co., to Hunkin-Conkey Co., 1740 E. 12 St., Cleveland; installing plumbing, heating and sheet metal work for above, to Gorman-Lavelle Plumbing & Heating Co., 2341 E. 22 St., Cleveland.

†**Ohio**—SURFACING TRACK, etc.—U. S. Eng., 25 New Federal Bldg., Pittsburgh, Pa., surfacing track, cleaning, ditching, etc., Contr. 36-058-eng-106, Trumbull Co., to Warren Constr. Co., Warren, **$50,000.**

†**Oklahoma**—IMPROVEMENTS, etc.—U. S. Eng., 416 Wright Bldg., Tulsa, Zone 2, imprvs. rehabilitation shoulders, Constr. 34-066-eng-68, Garfield Co., to Metropolitan Paving Co., Oklahoma City, **$60,000.**

†**Oklahoma**—UTILITIES, etc.—U. S. Eng., 231 W. Main St., Denison, Tex., utilities and railway spur track, Carter Co., to F. Parrott, 403 S. Haskell St., Dallas, Tex., approx. **$33,000.**

†**Pennsylvania** — WATCH REPORT and FIRE ALARM SYSTEM, etc.—U. S. Eng., Standard Oil Bldg., Baltimore, Md., watch report and fire alarm sys. and main cable, Contr. 18-020-Eng-154, Franklin Co., to Howard P. Foley Co., Inc., 2107 N. 6 St., Harrisburg, **$40,000.**

†**Pennsylvania**—FACILITIES—U. S. Eng., Standard Oil Bldg., Baltimore, Md., addnl. facilities, Contr. 18-020-Eng-142, Franklin Co., to H. B. Alexander & Son, 3 and Vaughn Sts., Harrisburg, **$50,000.**

†**Pa., Phila.**—PIER—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., downstream ice breaker pier, NAD, Fort Mifflin, near here, NOY 7622, to Thomas Earle & Sons, Inc., Real Estate Trust Bldg., **$69,058.** Bids 10/28. CD 10/13.

†**South Carolina**—IMPROVEMENTS—U. S. Eng., 33 Customhouse, Charleston, imprvs., bldgs., No. 38-081-44-78-Neg., Florence Co., to Boyle Constr. Co., Sumter, under **$50,000.** Bids 11/4.

†**Tennessee**—HANGAR REPAIRS, etc.—U. S. Eng., Grant St., west of Westwood St., Mobile, Ala., repair, construct and complete hangar, and strengthen trusses, Contr. 01-076-Eng-62 Shelby Co., to E. O. Korsmo Constr. Co., Porter Bldg., Memphis, **$40,000.**

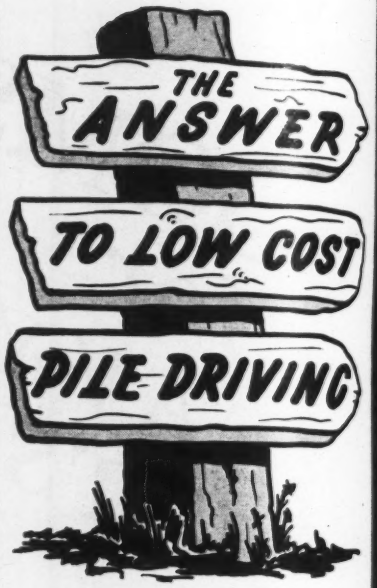
†**Tennessee**—STORAGE FACILITIES—U. S. Eng., Grant St., west of Westwood St., Mobile, Ala., open storage facilities, Ala. Ser. 180, Shelby Co., to Bowyer & Johnson, Jackson, under **$60,000.**

★†**Texas**—APRON, RUNWAY, etc.—U. S. Eng., Fort Sam Houston, aprons, runway and taxiways, electrical work and removal of tie down rings, Contr. 41-154-Eng-83, Bexar Co., to R. W. Briggs & Co., and N. B. Killian, Sunset Rd., San Antonio, **$500,000.** CD 11/3—ENR 11/11 under LB.

†**Texas**—IMPROVEMENTS—U. S. Eng., Fort Sam Houston, imprvs., gasoline fueling sys. relocation, revisions, expansions, etc., Bexar Co., to Farwell Co., 410 Builders Exchange Bldg., San Antonio, approx. **$25,000.** Bids 11/10. CD 11/5.

†**Texas** — IMPROVEMENTS — U. S. Eng., Fort Sam Houston, imprvs., parking apron, Midland Co., to Austin Road Co., P. O. Box 1590, Dallas, **$169,000.** Bids 11/10. CD 11/5.

★**Texas and West Virginia**—NATURAL GAS PIPELINE, etc.—Tennessee Gas & Transmission Co., P. O. Box 2511, Houston, laying 612 mi. 24 in. steel pipeline main natural gas carrier, from Corpus Christi to Edna, Tex., all in Louisiana, strip across Arkansas, 97 mi. in Mississippi and all in Tennessee, to Williams Bros. Corp., Kennedy Bldg., Tulsa, Okla., and Second National Bank Bldg., Houston, Tex., approx. **$13,000,000*****laying 120 mi. 24 in. gas pipeline between Cleveland, Tex.,



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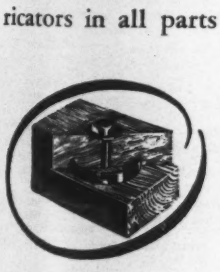

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UNCLASSIFIED (Contracts Awarded, Cont'd.) and Sabine River between Texas and Louisiana only, to Brown & Root, Inc., Corpus Christi, Tex., and 4300 Calhoun St., Houston, Tex., and W. E. Callahan Constr. Co., 3424 Amelia St., Dallas, Tex., approx. $2,500,000*** laying 120 mi. 24 in. gas pipeline from Edna to Cleveland, Tex., to N. A. Smith Constr. Co., Hicks Bldg., San Antonio, Tex., and San Jacinto Annex Bldg., Beaumont, Tex., approx. $2,400,000***laying 77 mi. 24 in. gas pipeline in Mississippi and all the line traversing Kentucky, to Bechtel-Dempsey-Price, c/o owner, $7,500,000***furnishing approx. 390 mi. 24 in. steel pipe to National Tube Co., for use on 1,188 mi. gas line between Corpus Christi, Tex., and Cornwell, W. Va., Lorain, O., approx. $3,275,000***installing, furnishing twenty-seven 1,000 hp. compressors along above gas pipeline, to Worthington Pump & Mchy. Corp., Harrison, N. J.***thirty-one 1,000 hp. compressors, to The Cooper-Bessemer Corp., 200 Thomas Ave., Mount Vernon, O.***constructing seven 58,000 hp. compressor stations and dehydration plant, to Stearns-Roger Mfg. Co., 1720 California St., Denver, Colo., $1,600,000. CD 11/9—ENR 11/11, under CA.

★†Texas—CONSTRUCTION—U. S. Eng. Off., W. Main St., Denison, construction at an Air Forces installation, Dallas Co., to Peter Kiewit Sons Co., MacDougald Constr. Co. and Western Contg. Corp., Sioux City, Ia., $1,700,000. Awarded 11/8. CD 11/4—ENR 11/11.

†Utah—IMPROVEMENTS—U. S. Eng. Off., Exchange Pl., Salt Lake City., imprvs., bldg. addns., Salt Lake Co., to R. H. Parr, 505 Beason Bldg., Salt Lake City, under $200,000. Bids 10/5.

†Utah—IMPROVEMENTS—U. S. Eng. Off., Exchange Pl., Salt Lake City, imprvs., remodeling, enlarging sewerage sys., Tooele Co., to Geo. Carruth & Son, Evanston, Wyo., $38,000. Bids 10/18.

†Virginia—ELECTRIC FACILITIES—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., addnl. electric facilities, Section Base, Little Creek, NOY 6467, to Industrial Power Equipment Co., 6 E. Center St., Baltimore, Md., $93,897.

†Virginia—PIER FACILITIES, etc.—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., addnl. pier facilities and bldg., NOY 7438, to McLean Contracting Co., 1301 Fidelity Bldg., Baltimore, Md., $204,270; addnl. dispensary facilities, NOY 7327, to Ross Engineering Co., 2301 16 St. N.W., Wash., D. C., $144,477, both at Amphibious Training Base, Little Creek. CD 3/18.

†Va., Norfolk—PLANE PARKING AREA—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., addnl. plane parking area, seaplane area, NAS, NOY 7268, to T. E. Ritter Co., Inc., 426 W. York St., $414,070. CD 9/27.

★†Wis., La Crosse—AIRPORT—Civil Aeronautics Admin., 608 S. Dearborn St., Chicago, Ill., airport, blacktop surfacing, to A-G-T. Associates, 201½ N. Dewey St., Eau Claire, $926,664. Bids 10/19—CD 10/14—ENR 9/30.

LATIN AMERICA

Mexico—Petroleos Mexicanos, et al, c/o L. Buenrostro, Mexico City, receiving bids, new hi-octane gasoline refinery, 2,000 bbl. daily capacity, refined project, in Atzapotzaloo, near Mexico City. $15,000,000. Arthur G. McKee Co., 2300 Chester Ave., Cleveland, O., U. S. A., engrs. CD 10/27—ENR 11/4.

Mexico—Mexican Federal Government, c/o Agriculture Div., Dpt. P. Wks., Mexico City, surveys started, constructing large earth, concrete and steel dam to provide flood control and irrigation facilities for over 200,000 acres in state of Sinaloa.

Mexico, Mexico City—National Railways of Mexico, L. Reina, ch. engr. M. W., 19 Bolivar St., Mexico City, plans central railway station. $12,000,000.

PUBLIC BUILDINGS

PROPOSED WORK

†California—U. S. Eng., 74 New Montgomery St., San Francisco, bldgs., Spec. 1156, San Francisco Co.

★†California—Vega Aircraft Corp., Burbank, addnl. plant facilities. Approx. $3,450,000. Defense Plant Corp. will finance.

†Calif., Alameda—Home Owners' Loan Corp., 1440 Bway., Oakland, Zone 12, plans by Blanchard, Maher & Ward, 369 Pine St., San Francisco, converting bldg. at 2553 Buena Vista Ave., into living units, Case No. W4D-122. Over $5,000.

†Calif., Alameda—Home Owners' Loan Corp., 1440 Bway., Oakland, Zone 12, plans by M. J. Marquis, 675 37 St., Oakland, converting bldg. at 1411 Encinal Ave. into living units. Case No. W4D-50. Over $5,000.

†Calif., Berkeley—Home Owners' Loan Corp., 1440 Bway., Oakland, Zone 12, plans by K. Ponsford, 900 Creek Rd., converting residence at 2749 Benvenue Ave. into 6 living units, Case No. W4B-1183. $12,000.

UBLIC BLDGS. (Proposed Work, Cont'd.)

†**Calif., Berkeley**—Home Owners' Loan Corp., 440 Bway., Oakland, Zone 12, plans by rman, Appleton & Associates, 68 Post St., Francisco, converting bldg. at 1716 Univer- y Ave. into living units, Case No. W4B-66. er $5,000.

†**Calif., Berkeley**—Home Owners' Loan Corp., 440 Bway., Oakland, Zone 12, plans by Lewis Koue, 525 Market St., San Fran- co, converting bldg. at 2015 Parker St. into ing units, Case No. W4B-991. Over $5,000.

†**Calif., Berkeley**—Home Owners' Loan Corp., 440 Bway., Oakland, Zone 12, plans by H. Reimers, 233 Post St., San Francisco, nverting property at 8 and Franklin Sts. to addnl. living units, Case No. W4B-899. ver $5,000.

†**Calif., Livermore**—Livermore Elementary chool Dist. plans by Chas. E. Butner, 7 inham St., Salinas, school bldg. $150,000.

†**Calif., Oakland**—Home Owners' Loan orp., 1440 Bway., Zone 12, plans by M. Johnson, 449 MacArthur Blvd., convert- g bldg. at 320 Hobart St. into living units, ase No. W4B-1230. Over $5,000.

†**Calif., Vallejo**—City of Vallejo Housing uth., Victory Apts., Ryder St., plans by D. H. ers, Hotel Claremont, Berkeley, 1,000 family elling units, Calif. 4767; plans by T. C. ernardi, 402 Jackson St., San Francisco, 500 ormitories, Calif. 4768. CD 11/1—ENR 11/4.

†**Colo., Cowdrey**—Pub. Housing Auth., NHA, erks Bldg., 1006 Grand Ave., Kansas City, o., 50 unit family stop-gap housing, Colo. 112.

†**Conn., Fairfield**—Pub. Housing Auth., HA, 24 School St., Boston, plans by Fletcher hompson, Inc., 211 State St., Bridgeport, ecreation bldg.-firehouse, Conn. 6071. CD 9—ENR 6/10.

†**District of Columbia**—Yards & Docks, avy Dpt., 18 St. and Constitution Ave. N.W., Wash., bldgs. $1,000,000.

†**D. C., Wash.**—Federal Works Agency, Pub. Bldgs. Admin., 18 and F Sts. N.W., ormitories. $850,000.

†**Idaho, Coeur d'Alene**—Pub. Housing Auth., HA, Skinner Bldg., Seattle, Zone 1, Wash., lans by Whitehouse & Price, Hutton Bldg., pokane, Wash., 60 unit housing, Idaho 10110.

†**Idaho, Pocatello**—Pub. Housing Auth., HA, Skinner Bldg., 5 Ave. and Union St., eattle, 1, Wash., plans by J. P. Jones, Hoge ldg., Seattle, 4, Wash., 110 unit trailer ousing, Idaho 10112, and 80 unit housing, daho 10111. CD 11/1—ENR 11/4.

†**Idaho, Triumph**—Pub. Housing Auth., HA, Skinner Bldg., 5 Ave. and Union St., eattle, 1, Wash., 30 unit family stop-gap ousing, Idaho 10113.

†**Illinois**—General Motors Corp., General Motors Bldg., Detroit, Mich., plant facili- ies. Approx. $2,200,000. Defense Plant Corp. ill finance.

†**Kentucky**—Curtiss-Wright Corp., Buffalo, N. Y., addnl. facilities at plant. Approx. 2,400,000. Defense Plant Corp. will finance.

†**Ill., Moline**—City, plans by W. H. Schulzke, oline, addn. to detention unit at hospital. 150,000. **FWA.**

†**Louisiana**—U. S. Eng., 25 St. and Avenue , Galveston, Tex., bldg., Sol. No. 41-248-44-C 0, East Baton Rouge Parish.

Mass., Peabody—City, Supt. Schools, 75 Cen- ral St., plans by J. M. Gray, 175 High St. Boston, brick high school addn. for trade chool, incl. machine shop, Stevens St.

†**Mass., West Roxbury**—Veterans Admin., Construction Bureau, Vermont Ave. be- ween H and I Sts. N.W., Wash., D. C., brick, teel, hospital addn. $1,500,000.

†**Mont., Great Falls**—Pub. Housing Auth., NHA, Skinner Bldg., 5 Ave. and Union St., eattle, 1, Wash., 100 unit family stop-gap ousing, Mont. 24030; 100 unit family stop- ap housing, Mont. 24031.

†**Neb., Bruning**—Home Owners' Loan Corp., Woodmen of the World Bldg., Omaha, 40 amily unit conversion program.

†**N. M., Belen**—Pub. Housing Auth., NHA, 1205 Electric Bldg., 7 and Taylor Sts., Fort Worth, Tex., plans by W. C. Kruger, Santa Fe. 50 unit dormitory housing, N.M. 29170; 50 unit family housing, N.M. 29171. CD 11/1 —ENR 11/4.

†**N. M., Ft. Stanton**—Pub. Bldgs. Admin., Electric Bldg., Fort Worth, Tex., exten. ex- sting Marine Hospital, incl. addn. to bldgs. for patients, storehouse, shops, power plant unit, garage, vocational bldg., etc. Over $150,000. **FWA.**

†**N. M., Gallup**—Pub. Housing Auth., NHA, 1205 Electric Bldg., Fort Worth, Tex., 60 unit family stop-gap housing, N.M. 29169.

†**N. M., Vaughn**—Pub. Housing Auth., NHA, 1205 Electric Bldg., 7 and Taylor Sts., Fort Worth, Tex., plans by Haynes & Strange, Parkhill, Voelcker & Dixon, Lubbock, Tex., 50 unit dormitory housing, N.M. 29173, and 20 unit family housing, N.M. 29174. CD 11/1—ENR 11/4.

†**Neb., McCook**—Pub. Housing Auth., NHA, 1006 Grand Ave., Kansas City, Mo., plans by L. A. Daly, engr.-archt., 556 Insurance Bldg., Omaha, 200 unit family housing, Neb. 25076. CD 11/1—ENR 11/4.

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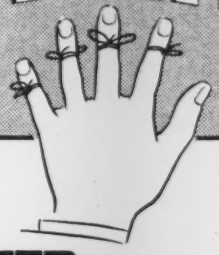

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PUBLIC BLDGS. (Proposed Work, Cont'd.)

†Ohio—Goodyear Tire & Rubber Co., [illegible] E. Market St., Akron, addn. plant facilities, $470,000. Defense Plant Corp. will finance.

O., North Canton—N. C. Community Library Assn., approved $65,000 bond issue for new library. $150,000.

†Okla., Ponca City—Pub. Housing Auth., NHA, 1205 Electric Bldg., 7 and Taylor Sts., Fort Worth, Tex., plans by Senter, Wood & Craig, 307 Philtower Bldg., Tulsa, 100 unit family trailer housing, Okla. 34077. CD 11/7—ENR 11/4.

★**†Oregon**—Maritime Comm., St. John plans by Wolff & Phillips, Pearson Ave. Bldg., Portland, waterproof roofing over assembly bays and provision of addnl. locker, drying and heated lunchrooms, etc., at Kaiser's Swan Island and Oregon yards, $2,000,000. Federally financed. V. Palmer, Oregon Shipbuilding Corp., St. Johns, engr.

†Ore., Brownville—Pub. Housing Auth., NHA, Skinner Bldg., 5 Ave. and Union St., Seattle, 1, Wash., 20 new homes and conversion of 5 bldgs.

†Ore., Klamath Falls—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., engineer-architect services for Whitehorse & Price, Hutton Bldg., Spokane, Wash., Marine Corps rehabilitation camp. NOY 8162.

†Ore., St. Helens—Pub. Housing Auth., NHA, Skinner Bldg., 5 Ave. and Union St., Seattle, 1, Wash., 35 new houses, conversion of 30.

†Ore., St. Helens—Home Owners' Loan Corp., Pacific Bldg., San Francisco, Calif., 12 family unit conversion program.

†Ore., The Dalles—Home Owners' Loan Corp., Pacific Bldg., San Francisco, Calif., 30 family unit conversion program.

Pa., Phila.—Dpt. Property & Supplies, Capitol Bldg., Harrisburg, plans by Geo. Wharton Pepper, Jr., 1600 Walnut St., Hospital facilities. CD 6/17/42—ENR 7/2/42.

Pa., Sunbury—Home Owners' Loan Corp., 2 Park Ave., New York, N. Y., 40 family unit conversion program.

†R. I., Newport—City, A. L. Noel, City Hall, recreation bldg., Aquisneck Park, $200,000. **FWA.**

†Tex., Brownwood—Pub. Housing Auth., NHA, 1205 Electric Bldg., Seventh and Taylor Sts., Fort Worth, 36 dormitory accommodations, Tex. 41-626.

★**Tex., Dallas**—V. R. Smitham, city mgr., City Hall, bond election Dec. 28 (tentative date), public market bldg. improv., $500,000.

†Tex., Galveston—Pub. Bldgs. Admin., Electric Bldg., Fort Worth, exten. existing Marine hospital plant, incl. storehouse and carpenter shop. **FWA.**

Tex., Houston—Houston Ind. School Dist., 1600 Washington Ave., plans by A. C. Finn, Bankers Mtg. Bldg., several 2 story, frame type school bldgs.

†Utah—Pub. Housing Auth., NHA, Dierks Bldg., 1006 Grand Ave., Kansas City, Mo., 100 unit family stop-gap housing, Utah 43127; 30 unit family stop-gap housing, Utah 43128, both at Drager.

Utah, Nephi—Juab Co. Bd. Educ. plans by Ashton & Evans, 312 Beneficial Life Bldg., Salt Lake City, rebuilding Nephi High School.

†Vt., Springfield—Pub. Housing Auth., NHA, 24 School St., Boston, Mass., plans by Leland & Larsen, 814 Statler Bldg., Boston, Mass., grading for housing, Vt. 43011 and 43014.

†Va., Newport News—Home Owners' Loan Corp., 2 Park Ave., New York, N. Y., 25 family unit conversion program.

†Wis., Racine-Kenosha—Pub. Housing Auth., NHA, 201 N. Wells St., Chicago, Ill., 150 unit family stop-gap housing, Wis. 47074.

BIDS ASKED

Bids Asked After November 16

†Mass., Holyoke—Pub. Housing Auth., NHA, 24 School St., Boston, grading, clearing site, etc., for housing, Mass. 19080. CD 11/9—ENR 11/11.

†Pa., Chester—Federal Works Agency, 346 Park Ave., New York, N. Y., school. $240,000. H. R. Robinson, 1927 11 St. N.W., Wash., D. C., archt. CD 11/8—ENR 11/11.

Bids Asked November 20

†Tex., Galena Park—Bd. Educ. (Galena Park), Ind. School Dist., Houston, school bldg., Tex. 41-633. $150,000. **FWA.** Hedrick & Lindsley, Southern Standard Bldg., Houston, archts. CD 9/23—ENR 9/30.

Bids Asked After November 20

†N. J., Perth Amboy—Perth Amboy Housing Auth., City Hall, yard drainage, pave walks, William Dunlap Homes, N.J. 6-2. for NHA. Plans deposit $5.

Bids Asked November 22

British Columbia—A. H. McKee, acting secy. Dpt. Transport, Ottawa, Ont., oil storage addn. to power house. Plans deposit $25.

Bids Asked About November 23

†Ga., Macon—Pub. Housing Auth., NHA, Georgia Savings Bank Bldg., Peachtree and Broad Sts., Atlanta, 252 dormitory units, Ga. 9166. E. Dunwoody, Macon, archt. CD 11/7—ENR 11/11.

PUBLIC BLDGS. (Bids Asked, Cont'd.)

Bids Asked November 23

†Pa., **Warminster**—Federal Works Agency, 101 Park Ave., New York, 17, N. Y., school, 36-214. $138,500. D. Supowitz, 246 S. 15 St., Phila., archt. CD 10/26—ENR 10/28.

Bids Asked About November 26

†Tex., **La Porte**—Bd. Educ., City Hall, brick, rein.-con. school bldg., incl. laboratory unit, Tex. 41-631. Plans deposit $25. Hedrick & Lindsley, 818 Southern Standard Bldg., Houston, archts. CD 10/13—ENR 10/21.

Bids Asked November 26

†Me., **Presque Isle**—Pub. Housing Auth., NHA, 24 School St., Boston, Mass., altering 3 bldgs., constructing fuel storage facilities, Me. 17051. Extended date. Plans deposit $50 first set, and $10 each addnl. set. CD 11/15—ENR 11/11.

Bids Asked After November 26

†Pa., **Scott Twp.**—Allegheny County Housing Auth., 201 County Office Bldg., Pittsburgh, site imprvs., Pa. 36212, for NHA. Extended date. Plans deposit $25. CD 11/5—ENR 11/11.

Bids Asked November 27

†Ga., **Dublin**—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C. (selected list bidders), administration bldg., X-ray and surgery bldg., receiving and laboratory bldg., subsistence and welfare, laundry, power plant bldgs., connecting corridors, Spec. 11829. CD 9/16—ENR 9/23.

†Mich., **Detroit**—Pub. Housing Auth., NHA, 2073 E. 9 St., Cleveland, O., 280 unit temporary family dwellings, Mich. 20212. Extended date. Malcolmson, Calder & Hammond, Inc., 1217 Griswold St., archts. CD 10/26—ENR 10/28.

Bids Asked About November 29

†Tex., **Beaumont-Port Arthur-Orange**—Pub. Housing Auth., NHA, 1205 Electric Bldg., Seventh and Taylor Sts., Fort Worth, 80 family dwelling units, Tex. 41-625. CD 11/1—ENR 11/4.

Bids Asked After November 29

†Md., **Middle River**—Pub. Housing Auth., NHA, Temporary Bldg. 2, 19 and D Sts. N.W., Wash., D. C., child's service center and tenant activity bldg., Md. 18099, for Baltimore City Housing Auth., 709 E. Eager St., Baltimore. Buckler & Fenhagen, 325 N. Charles St., Baltimore, archt.

Bids Asked About November 30

†Pa., **Chambersburg**—Pub. Housing Auth., NHA, 270 Bway., New York, 7, N. Y., 172 unit temporary dwelling housing, community bldg., Pa. 36436. Gleeson & Mulrooney, 1612 Market St., Phila., archts. CD 11/5—ENR 11/11.

Bids Asked November 30

†Ga., **Warner Robins**—Pub. Housing Auth., NHA, Georgia Savings Bank Bldg., Peachtree and Broad Sts., Atlanta, 1,960 family dwellings units, Ga. 9167 and 9169. Dennis & Dennis, Bankers Insurance Bldg., Macon, archts. CD 11/12.

Bids Asked About December 2

†Pa., **Middletown**—Pub. Housing Auth., NHA, 270 Bway., New York, 7, N. Y., 420 unit housing, Pa. 36439. Extended date. W. L. Murray, 1100 N. 2 St., Harrisburg, archt. CD 11/10—ENR 10/28.

Bids Asked December 6

†Mich., **Muskegon**—Pub. Housing Auth., NHA, 2073 E. 9 St., Cleveland, O., 100 unit temporary family dwellings, Mich. 20036. Extended date. Harley, Ellington & Day, Stroh Bldg., Detroit, archts. CD 10/27—ENR 10/14.

Bids Asked December 28

★†N. J., **Lyons**—Veterans Admin., Vermont Ave., between H and I Sts. N.W., Wash., D. C., 2 story, brick, rein.-con. addnl. bldgs., utilities at Veterans Hospital. $1,000,000. CD 10/12—ENR 10/14.

Bids Asked

†Conn., **Hartford**—Pub. Housing Auth., NHA, 24 School St., Boston, Mass., alterations, Type C bldgs., housing, Conn. 6128, 6129, 6131, 6133. CD 11/9—ENR 11/11.

†Massachusetts—U. S. Eng., 31 St. James Ave., Boston (selected list bidders), altering bldg., 19-023-44-NEG 118, Suffolk Co. $5,000.

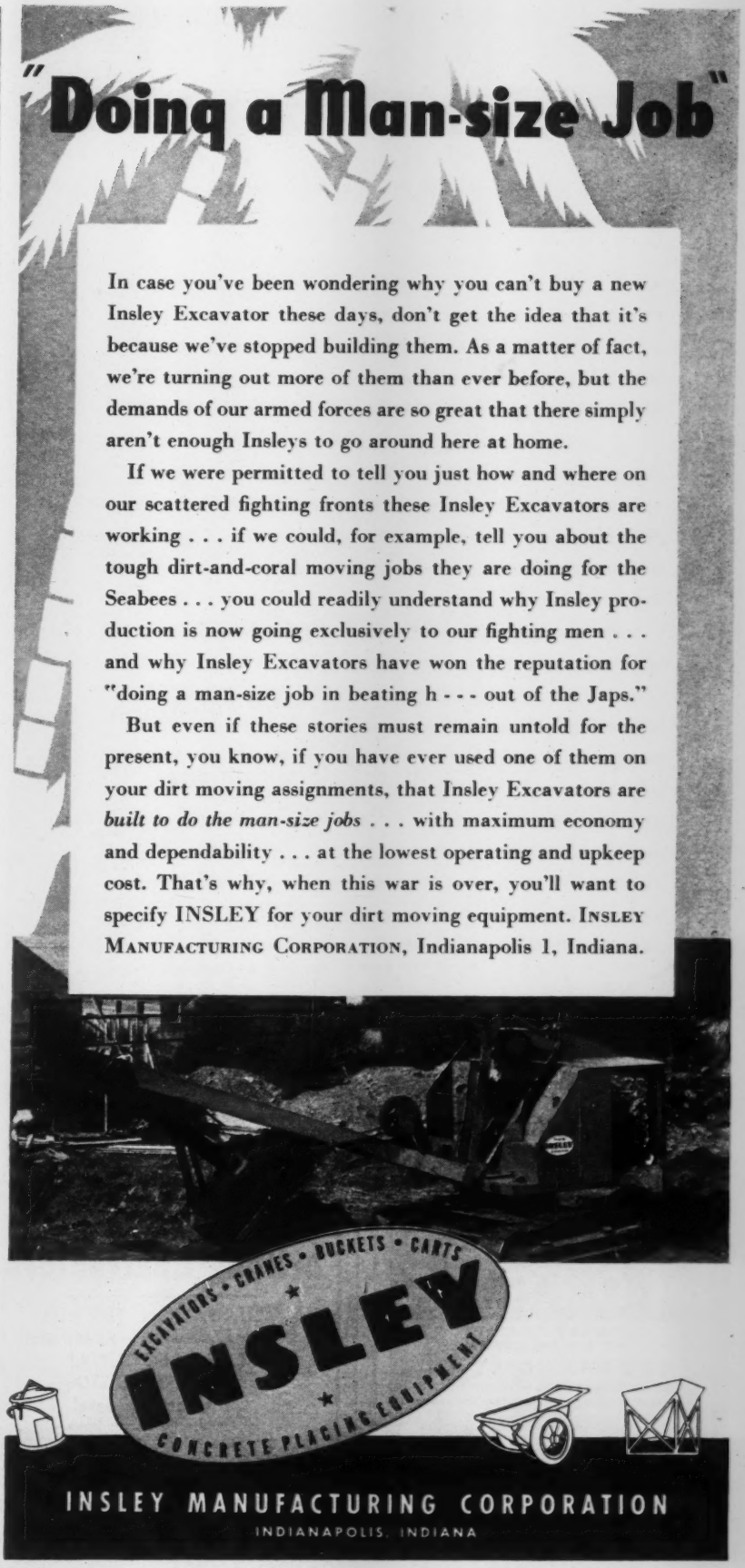
†Pa., **Hatboro**—Pub. Housing Auth., NHA, 270 Bway., New York, 7, N. Y., child service center and maintenance bldg., alterations, addns., Pa., 36251. Silverman & Levy, 1700 Sampson St., Phila., archts. CD 10/28—ENR 11/4.

†Pa., **North Braddock**—Allegheny County Housing Auth., 201 County Office Bldg., Pittsburgh, site imprvs., Pa. 36201, for NHA. Plans deposit $20. CD 9/30—ENR 10/7.

†Pa., **Phila.**—Pub. Housing Auth., NHA, 270 Bway., New York, 7, N. Y., 925 unit housing, Pa. 36013. S. A. S. Patorno, 101 Park Ave., New York, N. Y., engr.

LOW BIDDERS

†Conn., **Bantam**—Pub. Housing Auth., NHA, 24 School St., Boston, Mass., Nov. 12, sewage disposal plant and collection stations, housing Conn. 6052, from Millbrook Constr. Corp., 521 Fifth Ave., New York, N. Y., **$442,000.** CD 10/26—ENR 10/28.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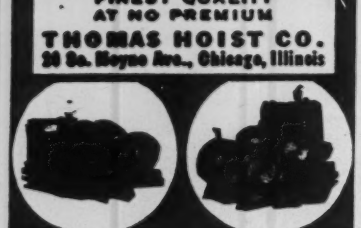

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PUBLIC BLDGS. (Low Bidders, Cont'd.)

†**Ind., Evansville**—Pub. Bldgs. Admin., 18 and F Sts. N.W., Wash., 25, D. C., Nov. 1, hospital addn. and nurses home at Protestant Deaconess Hospital, 614 Mary St., Ind. 12-182, from Baurer Constr. & Supply Co., 424 Lebanon Ave., Belleville, Ill., **$198,974.** FWA. Delayed bid. CD 11/5—ENR 11/11 under LB.

†**Mich., Bay City**—Pub. Bldgs. Admin., 18 and F Sts. N.W., Wash., D. C., Nov. 12, hospital, Mich. 20-141, from Spence Bros., 303 Brewer Arcade, Saginaw, **$215,870.** FWA. CD 10/19—ENR 10/21.

†**N. J., Trenton**—Pub. Housing Auth., NHA, 270 Bway., New York, 7, N. Y., 120 unit housing, N.J. 5-3, from White Plains Constr. Co., 200 Dobbs Ferry Rd., White Plains, N. Y., **$397,167.** CD 10/20—ENR 10/28.

†**O., Elyria**—Lorain Metropolitan Housing Auth., Central Dr., Lorain, 40 unit permanent dwellings, Ohio 33262, from W. B. Gilson Co., Warren, **$242,000.** CD 11/8—ENR 11/11.

★†**Pa., Allentown** — Allentown Housing Auth., Hanover Acres, Nov. 5, 260 unit housing, Pa. 36438, for NHA, from Rubin Constr. Corp., 11 W. 42 St., New York, 18, N. Y., **$732,850.** CD 10/25—ENR 10/28.

†**Tenn., Humboldt**—Pub. Bldgs. Admin., 18 and F Sts. N.W., Wash., 25 D. C., Oct. 28, general hospital, Tenn. 40-183, from Gardner Constr. Co., McGavock Lane, Nashville, **$336,400,** Alt. A, **$2,000** ded., Alt. B, **$700** deduct. Bid delayed. CD 11/4—ENR 11/11 under LB.

★†**Va., Portsmouth**—Federal Works Agency, 18 and F Sts. N.W., Wash., D. C., Nov. 9, hospital and nurses home, Va. 44-272, from J. O. Burgwin & Co., Professional Bldg, Pittsburgh, Pa., **$847,400.** CD 10/18—ENR 10/21.

CONTRACTS AWARDED

†**California**—So. California Gas Co., 810 S. Flower St., Los Angeles, Zone 14, heat exchanger and supports, chlorinator bldg., dump pit, to Ford J. Twaits Co., 451 Boylston St., Los Angeles, approx. **$300,000.** Defense Plant Corp. will finance. F. J. Alexander, 810 S. Flower St., Los Angeles, engr.

★†**California**—U. S. Eng., 74 New Montgomery St., San Francisco, addnl. housing, Contr. 04-203-Eng-195, Siskiyou Co., to Ford J. Twaits Co., 451 S. Boylston St., and Morrison-Knudsen Co., Inc., 411 W. 5 St., Los Angeles, **$800,000.** CD 8/25—ENR 9/2.

★†**Calif., Richmond**—Housing Auth. of City of Richmond, Administration Blvd., Atchison Village, 368 family dwelling units, community bldg., child service center and site imprvs. Pullman War Apts., Calif. 4763, for NHA, to S. J. Amoroso Constr. Co., 2136 Alemany Blvd., San Francisco, Proposal 2 **$696,300.** CD 11/9—ENR 11/11, under LB.

★†**Calif., Richmond**—Housing Auth. of City of Richmond, Administration Bldg., Atchison Village, 494 family dwelling units, community bldg., child service center, site imprvs., Seaport War Apts., Calif. 4762, for NHA, to Standard Building Co., 1500 Judah St., San Francisco, Proposal 3, **$842,815.** CD 11/9—ENR 11/11, under LB.

†**Calif., San Diego**—Pub. Housing Auth., NHA, 785 Market St., San Francisco, erosion control and landscape work in connection with housing, Calif. 4096, to J. W. Brem, 647 Spreckels Bldg., **$32,122.** H. Louis Bodmer, 601 Commonwealth Bldg., and W. Wurdeman and W. Becket, 6536 Sunset Bldg., Hollywood, archts.

†**Calif., San Diego**—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., bldgs., Marine Corps. Women's Reserve facilities, Camp Elliott, NOY 7251, to James I. Barnes Constr. Co., 1119 Montana Ave., Santa Monica, **$495,214.**

†**Calif., San Pedro**—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., D. C., fire fighting school Terminal Island, N O B, NOY 7567, to Harvey A. Nichols Co., 936 E. Slauson Ave., Los Angeles, **$220,990.**

†**D. C., Anacostia**—Yards & Docks, Navy Dpt., 18 St. and Constitution Ave. N.W., Wash., ship's service bldg., etc., Naval Training Center, NOY 7452, to V. R. Beauchamp, 2601 Connecticut Ave. N.W., Wash., Zone 8, **$135,888.** CD 10/21.

★†**Idaho, Farragut**—Yards & Docks, Navy Dpt., 18 St. and Constitutoin Ave. N.W., Wash., D. C., 5,000 man service school group, Naval Training Sta., NOY 6910, to C. F. Davidson Co., 711 Bway., Tacoma, Wash., **$2,105,800.** Bids 10/29. CD 11/4 under Unclassified, L.B.

†**Maryland**—U. S. Eng., 1 and Douglas Sts. N.W., Wash., D. C., Nov. 5, bldgs., from W. B. Avery, 629 F St., Wash., D. C., **$330,678.**

†**Michigan**—U. S. Eng., 700 Union Guardian Bldg., Detroit, 31, fire station, to E. Wohlg, Saginaw.

†**Michigan**—U. S. Eng., 700 Union Guardian Bldg., Detroit, 31, warehouse, Macomb Co., to Industrial Constr. Co., 5315 Seminole St., Detroit.

†**Mich., Willow Run**—Pub. Housing Auth., NHA, 2073 E. 9 St., Cleveland, O., community facilities, expansion theatre, police and fire station, gas station for housing, MI. 20060, to M. E. Greenberg Co., Transportation Bldg., Detroit, **$194,300.**

PUBLIC BLDGS. (Contracts Awarded, Con.)

†**New Jersey**—Best Blades, Inc., 36 Green St., Newark, factory, to Kugel Const. Co., 224 Waverly Ave., Newark, **$40,000.** Defense Plant Corp. will finance. CD 8/25—ENR 9/2, under Industrial Bldgs.

†**New Jersey**—U. S. Eng., 120 Wall St., New York, 5, N. Y., bldgs., Essex Co., to Walter Kidde Co., 140 Cedar St., New York, N. Y., **$250,000.** Bids 11/4. CD 11/1—ENR 9/2.

†**New Jersey**—U. S. Eng., 120 Wall St., New York, 5, N. Y., housing, Contr. 30-075-Eng-124, Somerset Co., to Andrew Christensen & Son, Inc., 1140 E. Jersey St., Elizabeth, **$400,000.**

†**New Jersey**—U. S. Eng., 120 Wall St., New York, 5, N. Y., addnl. bldgs., Contr. 30-075-Eng-198, Hudson Co., to Foundation Co., 120 Liberty St., New York, N. Y., **$200,000.** CD 10/1—ENR 10/7.

†**New York**—U. S. Eng., 120 Wall St., New York, 5, New York, addnl. housing, Contr. 30-075-Eng-284, Nassau Co., to Roberts Nash Constr. Corp., 39-15 Main St., Flushing, **$200,000.** CD 10/21.

†**Ohio**—U. S. Eng., Dayton, addns., Greene Co., to James I. Barnes Constr. Co., 131 N. Ludlow St., Dayton, **$300,000.**

★†**O., Akron**—Pub. Housing Auth., NHA, 2073 E. 9 St., Cleveland, 500 unit prefabricated temporary family dwellings, Ohio 33279, to A. P. Miller, Inc., 3333 Arctic Ave., Atlantic City, N. J., **$1,537,000.** Awarded 11/9. CD 11/3—ENR 11/11, under LB.

†**Oklahoma**—U. S. Eng., 231 W. Main St., Denison, Tex., addnl. facilities, Contr. 41-242-Eng-52, Carter Co., to Builders Constr. Co., Perrine Bldg., Oklahoma City, **$300,000.**

†**Pennsylvania**—U. S. Eng., Standard Oil Bldg., Baltimore, Md., installing boiler and laundry equip., Contr. 18-020-Eng-137, Butler Co., to Sans Co., 59 Winsor St., Jamestown, N. Y., **$40,000.** Bids 9-17. CD 9/13—ENR 9/16.

†**Pennsylvania**—McCreary Tire & Rubber Co., F. C. Rankin, factory supt. in charge, Indiana, general contract automobile tire mfg. plant, to O. H. Martin, 513 Homewood Ave., Pittsburgh. Est. **$165,000.** Defense Plant Corp. will finance. Bids 10/30. CD 11/1—ENR 11/4.

†**Virginia**—U. S. Eng., Fort Norfolk, Norfolk, tant frames, shelves and table, etc., Contr. 44-110-Eng-2739, Henrico Co., to Grannis, Thompson, Street & Wattinger Co. Newport News, **$200,000.**

★†**Wash., Seattle**—Pub. Housing Auth., NHA, Skinner Bldg., 5 Ave. and Union St., Seattle. Zone, 4, 240 unit housing, Wash. 45340 and 72 unit dormitory housing, Wash. 45341, at Auburn, for King Co. Housing Auth., 4th and Cherry Bldg., to Nettleton & Baldwin, 6803 Fox St., Zone 8, **$518,000.** CD 11/4—ENR 11/11 under LB.

COMMERCIAL BUILDINGS

PROPOSED WORK

Calif., Compton—Gage Corp., 468 N. Camden Dr., Beverly Hills, plans by Wm. J. Gage, 468 N. Camden Dr., Beverly Hills, 84 frame, stucco duplex dwellings. Over $150,00.

Conn., Manchester—Manchester Memorial Hospital, 71 Haynes St., brick, steel nurses home, training school, Haynes St. $150,000.

Ga., Columbus—Columbus Homes, Inc., twenty-six 2 family residences, Cusseta Rd., $170,000.

La., New Orleans—L. P. Smith, 4223 Palmyra St., plans by G. Riehl, 4630 Orleans Ave., seven new 4-plex bldgs., 12 duplex bldgs., facilities, utilities. $150,000.

Minn., St. Paul—Midway Mounds School of Nursing, 1700 University Ave., (affiliated with Midway Hospital), plans by Toltz, King & Day, 1509 Pioneer Bldg., nurses home, etc. Over $150,000. Seeking federal funds.

Neb., Omaha—Clarkson Hospital, C. Meister, supt., nurses home, $200,000. Applying for FWA funds.

Tex., Dallas—West Ridge Park Corp., 2900 W. Davis St., 28 frame type dwelling, facilities, utilities, $150,000.

Tex., El Paso—C. H. Leavell, El Paso, housing. $275,000.

CONTRACTS AWARDED

Calif., Los Angeles—Federated Builders, Inc., 8473 Beverly Blvd., Los Angeles, 72 frame, stucco dwellings. Owner builds. Over $150,000. H. J. Hamer, 8473 Beverly Blvd., archts.

Calif., North Long Beach (Sta. Long Beach)—J. M. Lenney Bldg. Co., 1360 Newport Ave., Long Beach, 171 frame, stucco dwellings. Owner builds. Over **$150,000.** H. Gibbs, 345 Carroll Park, West, Long Beach, archt.

Calif., Santa Monica—Geo. A. Froley, 9011 Wilshire Blvd., Beverly Hills, 8 frame, stucco triplex apartment bldgs. Owner builds. $150,000.

Calif., Ventura—Ventura Defense Housing Corp., 4700 Clark Ave., Lakewood Village, 120 frame, stucco dwellings. Owner builds. Over $150,000. M. W. Baird, 947 N. Isabel St., Glendale, archt.

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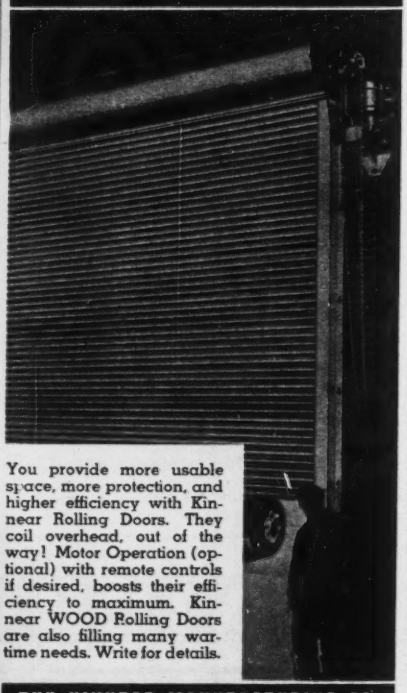

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COMMERCIAL BLDGS. (Contracts Awarded Cont'd.)

Conn., Fairfield—E & F Constr. Co., 94 W... St., Bridgeport, twenty 1½ story, brick, ... residential development, stone fdns., ... Pine Creek Court. Owner builds. **$150,000.**

Conn., Stamford—Colonial Gardens, Inc., c/o Kelly & Gruzen, archts., 46 Ridge St., North Arlington, N. J., 2 story, garden apartment project, 45 dwelling units, Summer St. to One Fifty Five Union Avenue Corp., Ridge Rd., North Arlington, N. J. **$160,000.**

La., New Orleans—Pearl Homes, Inc., New Orleans, duplexes, facilities, utilities, etc., to Pittman Bros. Constr. Co., 2890 N. Galvez St., approx. **$150,000.** CD 11/4—ENR 11/11.

★**Md., Middle River**—Middle River Manor, Inc., 22 W. 48 St., New York, N. Y., one hundred 2 story, bsmnt., family dwelling units, to M. Shapiro & Sons, 254 W. 54 St., New York, N. Y. **Est. $3,600,000.** Alex. Crosett, 512 Fifth Ave., New York, N. Y., archt.

★**Ore., Portland**—Wesco Bldg. Co., Terminal Sales Bldg., one hundred eighteen 4 and 5 room dwelling units, Borden Heights Proj., and one hundred twenty-five 4 and 5 room dwelling units, Delores Heights Proj., to Myers Bros., 3407 San Fernando Rd., Los Angeles, Calif., **$692,500** and **$718,750** respectively. D. J. Stewart, Central Bldg., Vancouver, Wash., archt. Beasley & Stoetzel, Railway Exchange Bldg., Portland, engrs. for 1st project.

Tex., Dallas—Gibraltar Bldg. Corp., 2... Blk. Alco St., 22 or more brick veneer dwellings. Owner builds. **$150,000.**

★**Tex., Dallas**—Western Hills Realty Co., 2717 Kendale, two hundred seventeen 1 story, frame dwellings, to Longhorn Constr. Co., 3901 Elm St. **$775,000.** H. S. Avery, 2717 Kendall, archt. CD 11/4—ENR 11/11.

Tex., Fort Worth—Linwood Development Co., 2700 Merrimac St., sixty-one 1 story, 28x40 ft., frame duplexes, to New River Lumber Co., 300 Carroll St., Houston, **$224,...**

★**Tex., Houston**—Frank W. Sharp Const. Co., 1505 4 St., 526 hollow tile, frame type dwellings, Owner builds. Approx. **$1,500,...** H. H. Alexander, 4904 Laurel St., archts. CD 11/5—ENR 11/11.

Tex., San Antonio—L. G. Hodges, c/... Campbell Lumber Co., 1339 S. Flores, 2 story duplexes. Owner builds. **$150,000.** CD 11/... —ENR 11/11.

Ont., Ottawa—R. McClelland, 49 Frank St., Ottawa, 40 brick veneer homes, concrete fdns., Riverdale Ward, day labor. **$226,000.**

INDUSTRIAL BUILDINGS

PROPOSED WORK

Ark., Osceola—PLANT—Mississippi Valley Canning Co., dehydration plant for stock feed, $100,000.

N. C., Charlotte—RAILWAY SHOPS—Southern Railway Sys., G. L. Sitton, ch. engr. (Eastern Lines) 713 W. Trade St., shop enlargements, 22½ x 175 metal addn., 60 x 200 ft. brick shop bldg., 40 x 108 brick storage bldg., 312 W. Liddell St. Approx. $65,000.

N. H., Laconia—COLD STORAGE PLANT—Lake City Frozen Food Bank, D. Colby, group, cold storage plant, 500 capacity quick freezing lockers, Canal Court.

★**Ohio**—PLANT—Seiberling Rubber Co., J. P. Seiberling, pres., Barberton, synthetic rubber tire and tube mfg. plant expansion. $1,500,000.

Pa., Somerset—FOOD LOCKER and FREEZING PLANT—Somerset Farm Bureau Cooperative Assn., G. Freidline, in charge, S. Edgewood Ave., sketches by C. C. Compton, 4 Ave and Thompson St., Donora, 2 story, bsmnt., 65x120 ft., tile food locker and freezing plant, S. Edgewood and Cannel Sts. $60,000. CD 10/6—ENR 10/14.

★**Tenn., Memphis**—PLANT—International Harvester Co., F. McCormick, pres., 180 N. Michigan Ave., Chicago, Ill., cotton picker factory, east bank of Loosahatchie River, $5,000,000. CD 4/29/42—ENR 5/7/42.

★**Texas**—PLANT—Celanese Corp. of America, 180 Madison Ave., New York, N. Y., plastic and acetic acid mfg. plant, $4,500,000.

★**Tex., Lufkin**—MILL—Southland Paper Mills, Inc., Lufkin, doubling capacity existing newsprint pulp mfg. mill, $3,000,000.

B. C., Van Anda—CRUSHING PLANT—Beale Quarries, Ltd., Van Anda, crushing plant, other necessary bldgs., 100 tons daily capacity, Texada Island. $40,000. Engineer, c/o W. D. Webster, Van Anda.

B. C., Van Anda—MINING, etc.—Industrial Metal Mines, Ltd., L. A. Prosser, engr., Van Anda, rehabilitating old mining buildings, $50,000; WW sys., pipeline from Turtle Lake to reservoir on Copper Queen Hill, $30,000, all above at Texada Island.

B. C., Warfield—PLANT—Consolidated Mining & Smelting Co. of Canada, Ltd., Trail, phosphate plant addn., alterations, constructing storage plant, storage shed for 75,000 gal. P2-05 and installing equip. $226,200.

N. B., Saint John—POWER PLANT—N. B. Electric Power Comn., Saint John, power plant addn.

Ont., Ancaster—PLANT—Brockton Textiles, Ltd., Ancaster, mfg. plant. $40,000.

Que., Montreal—PLANT—Barrett Co., Ltd., 5551 St. Hubert St., remodeling part of plant. $40,000.

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INDUSTRIAL BLDGS. (Contracts Awarded, Cont'd.)

Que., Montreal—PLANT—United Tire & Supply Co. Ltd., 671 W. St. James St., Montreal, reconstructing plant. $40,000.

CONTRACTS AWARDED

Conn., Bridgeport — GARAGE, etc. — Gray Line Bus Corp., H. Burns, pres., 137 Dover St., 2 story, 95x100 ft. bus garage and office bldg., Dover St. Terminal, to De Fonce Constr. Co., 110 Colonial Ave. Est. $45,000. H. E. Koerner, Grovers Ave., archt. CD 11/4—ENR 11/11.

Conn., Oakville—BOILER HOUSE—Autoyre Co., Oakville, brick boiler house, to Fusco-Amatruda Co., 59 Amity Rd., New Haven. Est. $60,000. W. W. Gaylord, 131 Underhill Rd., Hamden, Zone 14, consult. engr. (Correction—engineer). CD 10/28—ENR 11/4.

Md., Baltimore — ROUNDHOUSE — Baltimore & Ohio R. R. System, A. C. Clark, ch. engr., Baltimore & Ohio Bldg., roundhouse alterations, addns., to Steiner Constr. Co., 2122 Maryland Ave., $45,000.

Md., Baltimore — PLANT — Gordon Lavin Paper Box Co., 1629 Warner St., 1 story, 44x225 ft., brick plant addn., to M. Pugatch, c/o owner. Est. $45,000. Crout, Snyder & Crandall, 20 E. Lexington St., engrs.

Minn., Owatonna—PLANT—Josten Mfg. Co., 2 story, 80x115 ft., rein.-con., brick mfg. plant, to Eric Carlstrom Constr. Co., 152 Shadywood Ave., Mankato. Est. $100,000. Magney, Tusler & Setter, 202 Foshay Tower, Minneapolis, archts. CD 7/7—ENR 7/15.

Neb., Lincoln—SPRAY POWDERED MILK PLANT—Roberts Dairy Co., 20 and North Sts., spray powdered milk plant addn. to Ernest Rokahr & Sons 1815 Y St. Est. $100,000. CD 9/22—ENR 9/30.

N. J., Newark—FACTORY—United Electronics Co., 42 Spring St., factory bldg., to Edmund Stearns, Inc., 54 Glenridge Ave., Montclair, $40,000. Epple & Kahrs, 15 Washington St., archts. CD 10/27—ENR 11/4.

O., Ashland—FACTORY—Eagle Rubber Co., Inc., R. Long, pres., Ashland, 1 story, 80 x 140 ft., brick, steel, concrete factory, to Hartman & Freeble, Shelby. Althouse & Jones, 28 Park Ave., Mansfield, archts.

O., Willoughby—PLANT—Ohio Rubber Co., R. Keach, purch. agt., Ben Hur Ave., 3 story, 51 x 80 ft., brick, steel factory addn., 1 story, 20 x 60 ft., refrigeration bldg., to G. Rutland, 16 Brown St. Est. $50,000.

Pa., Oil City—PLANT BUILDINGS—Talon, Inc., Steel Tube Div., F. J. Schaffer, supt., Seneca St., 1 story, 53x130 ft., steel frame, brick storage and unloading bldg., and 1 story, 20x30 ft. dispensary bldg., etc., to L. O. Boquin, 11 E. First St. Est. $60,000.

Pa., Pittsburgh — PLANT — Kerotest Mfg. Co., A. Anderson, purch. agt., 2524 Liberty Ave., 1 story, 100 x 146 ft., brick, steel shop bldg., to O. H. Martin, 513 Homewood Ave. S. L. Roush, 312 Chamber of Commerce Bldg., archt. CD 10/27—ENR 11/4.

Pa., Waynesboro — LABORATORY—Landis Machine Co., Waynesboro, brick, steel laboratory bldg. and connecting passage to present bldg., to Cummins Constr. Corp., 803 Cathedral St., Baltimore, Md., $40,000. Alex. D. Crosett, 512 Fifth Ave., New York, N. Y., engr.

Tex., Mission — PLANT — Missouri Pacific R. R. Co., F. E. Bates, ch. engr., Missouri Pacific Bldg., St. Louis, Mo., 1 story, brick, concrete meat and vegetable processing plant. Owner builds. $40,000. CD 10/29—ENR 11/4.

Ont., Cornwall—PLANT—Canada Cottons Ltd., W. V. Boyd, vice pres., Cornwall, plant addn., to A. W. Robertson, Ltd., 57 Bloor St. W., Toronto, about $100,000.

Ont., Malton (Toronto)—STORAGE—Trans-Canada Air Lines, 360 McGill St., Toronto, 200x300 ft. storage bldg. near plant, to Redfern Constr. Co. Ltd., Excelsior Life Bldg., 36 Toronto St., Toronto, about $150,000-$200,000.

Ont., North York (P.O. Dist. Toronto)—PLANT, etc.—de Havilland Aircraft of Canada, Ltd., 14 Sheppard Ave., Toronto, 60 x 210 ft., and 60 x 300 ft., brick, steel plant addn., concrete fdn., also altering Plant 2, to A. W. Robertson Ltd., 57 W. Bloor St., Toronto, $200,000, cost plus basis, E. A. Cross, 991 W. Bloor St., Toronto, engr.; runway exten., taxi strips, aircraft park, hangar concrete apron, to G. W. Porter Constr. Co. Ltd., 201 Harbour Bldg., Toronto, $170,000 cost plus basis; D. Sheppard, 57 W. Bloor St., Toronto, engr. CD 9/29—ENR 10/7.

Ont., Owen Sound—PLANT—W. Kennedy & Sons, Ltd., 1114 1 Ave., rein.-con., brick, plant addn., to Wells & Gray Ltd., Confederation Bldg., Toronto, $45,000. E. A. Leigh, 859 E. 2 Ave., archt. Ewart, Armer & Byam, 36 Toronto St., Toronto, engrs. CD 1/12—ENR 1/14.

Ont., Peterborough — PLANT — Can. Gen. Electric Co. Ltd., 212 W. King St., Toronto, 80 x 200 ft., brick plant addn., concrete fdn., to Eastwood Constr. Co. Ltd., Dominion Bank Bldg., Toronto. Beck & Eadie, 220 W. Bloor Stt., Toronto, archts.

P. E. I., Montague—PLANT—W. Waterworth Co., Montague, cold storage plant, to Samuel Martin Co., Dundee. Est. $40,000.

Proposal Advertisements see p. 214 & 215
Postwar Projects see p. 176

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As an engineer you know the drastic shortage of structural steel shapes. You know that timber is now being used to relieve this critical shortage. Yet you are accustomed to thinking in terms of steel and concrete. Here is a book that will enable you to readjust your thinking and methods to fit up-to-date design in modern timber. MODERN TIMBER DESIGN gives you the information you want—the properties of various species of trees, factors affecting their structure, their assigned working stresses and how their use in design differs from other materials.

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SEND COPY *to Official Proposal Division, Engineering News-Record, 30 W. 42nd St., New York, N. Y.*

(U. S. Government)

FEDERAL WORKS AGENCY
Office of the Administrator
Advertisement

Sealed proposals will be received in the office of Mr. Kenneth Markwell, Regional Director, Federal Works Agency, State Planters Bank Building, Ninth and Main Streets, Richmond, 19, Virginia, until 2:00 p.m. EWT, December 14, 1943, and then publicly opened and read aloud *for the purchase of 14 Transmarine Barges of riveted steel construction*, suitable for transportation of construction materials and equipment or general cargoes.

These barges are located at Norfolk, Virginia. Dimensions of nine of the barges are 104.4'x21.6'x10.9', capacity of 13,728 cu. ft. and displacement at 1 ft. free load of 450 tons, designed with a rake bow and stern straight sides and diagonal bilges. The dimensions of five of these barges are 104.4'x20.5'x10.7', capacity of 14,238 cu. ft. and displacement at 1 ft. freeboard of 500 tons, designed with twin steel bitts at the bow and a hand operated capston. Hatch openings are of three sizes, 13'-0"x69'-7½", 14'-7"x69'7½" and 13'-0"x78'-6". The draft of the barges when empty is about 23" to 26".

Detailed information is available at the Office of the Regional Director. These barges can be inspected by contacting Mr. L. L. Pearsall, Principal Engineer, Federal Works Agency, 201 Adams Building, Norfolk, Virginia.

Bid guarantee of 5 per cent of the amount of the proposal must be furnished by each bidder.

Proposals will be received on one or more of the barges and must be submitted on Form of Proposal furnished by the Regional Director.

The right is reserved, as the interest of the government may require, to reject any and all bids, to waive any informality in bids received, and to accept or reject any items of any bid.

The envelopes containing bids must be sealed, marked and addressed as follows: Mr. Kenneth Markwell, Regional Director Federal Works Agency, 601 State Planters Bank Building, Richmond, 19, Virginia.

(197)

Additional OFFICIAL PROPOSAL Advertisements on opposite page

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This WHERE TO BUY *Section* supplements other advertising in this issue with these additional announcements of products and services essential to efficient and economical operation in the construction industry.
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SEND COPY TO OFFICIAL PROPOSAL DIVISION, ENGINEERING NEWS-RECORD, 330 W. 42ND ST., NEW YORK, N. Y.

(Continued from opposite page)

OFFICIAL PROPOSALS

Bids: Dec. 8, 1943 (195)

State Highway Work

Sealed proposals will be received by the State Highway Department at its office, Dover, Delaware, until 2.00 P. M. E. W. T., December 8, 1943, and at that time and place publicly opened for contracts involving the following approximate quantities:

CONTRACT 833
Slaughter Beach Groins
Slaughter Beach, Sussex Co.
2 — 150 ft. Timber Groins
1400 Lin. Ft. Creosoted Timber Piles
18M B. M. Creosoted Timber Sheeting
4M B. M. Creosoted Timber Wales

Attention is called to the Special Provisions in the proposal, specifications and contract agreement.

Performance of contract shall commence within ten (10) days after execution of the contract and be completed as specified.

Monthly payments will be made for 90 per cent of the construction completed each month.

Bidders must submit proposals upon forms provided by the Department.

Each proposal must be accompanied by a surety bond, certified check, or money to the amount of at least ten (10) per centum of the total amount of the proposal.

The envelope containing the proposal must be marked "Proposal for the construction of State Highway Contract No. ....."

The contract will be awarded or rejected within twenty (20) days from the date of opening proposals.

The right is reserved to reject any or all bids.

Complete sets of plans and specifications may be obtained after November 18, 1943 upon receipt of two dollars ($2.00) for each contract, which amount will not be refunded.

Make checks payable to the State Highway Department.

STATE HIGHWAY DEPARTMENT
By: F. V. duPont, Chairman.
W. W. Mack, Chief Engineer.
Dover, Delaware.
November 10, 1943.

Bids: December 3, 1943 (196)

Water Main & Sewer Construction

WASHINGTON SUBURBAN SANITARY COMMISSION
WATER MAIN AND SEWER CONSTRUCTION

Sealed proposals for constructing approximately 160 feet of 6-inch, 170 feet of 8-inch and 35 feet of 12-inch cast iron water mains and 960 feet of 6-inch and 5,020 feet of 8-inch vitrified pipe sewers on Contract No. 168-W&S, will be received at the office of the Washington Suburban Sanitary Commission, Hamilton Street, Hyattsville, Maryland, until 3:00 P. M., Eastern War Time, Friday, December 3, 1943, at which place and time they will be publicly opened and read.

Plans and specifications may be obtained from Harry R. Hall, Chief Engineer of the Commission, Hyattsville, Maryland, upon deposit of $5.00, which deposit will be returned to bidders or to those returning plans and specifications in good condition.

Perry Boswell
J. Donald Clagett
Frank B. Smith
Commissioners

Bids: Dec. 3, 1943 (198)

Sewer Construction

WASHINGTON SUBURBAN SANITARY COMMISSION
SEWER CONSTRUCTION

Sealed proposals for constructing approximately 600 feet of 8-inch, 1,000 feet of 10-inch, 425 feet of 12-inch and 830 feet of 15-inch vitrified pipe sewers on Contract No. 169-S, will be received at the office of the Washington Suburban Sanitary Commission, Hamilton Street, Hyattsville, Maryland, until 3:30 P. M., Eastern War Time, Friday, December 3, 1943, at which place and time they will be publicly opened and read.

Plans and specifications may be obtained from Harry R. Hall, Chief Engineer of the Commission, Hyattsville, Maryland, upon deposit of $5.00, which deposit will be returned to bidders, or to those returning plans and specifications in good condition.

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for continuous advertising to reach your prospects at the height of their buying interest

for spotting the most important prospects for special attention

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McGraw-Hill Publishing Co., Inc.

330 West 42nd St., New York 18, N. Y.

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BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

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The advertising rate is $6.90 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

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NEW ADVERTISEMENTS received by November 26th appear in December 2nd issue subject to limitation of space available

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P-981, Engineering News-Record
330 W. 42nd St., New York 18, N. Y.

POSITIONS VACANT

These Positions Vacant advertisements are published subject to agreement by the advertisers not to consider applicants now employed on war work unless they obtain written release from present employer.

ENGINEER or ESTIMATOR. Graduate Engineer 30-40 with experience in building construction. Permanent connection for the proper man. Give age, education, experience, salary expected, reference and draft status in first letter in own handwriting. Enclose recent photo. P-969, Engineering News-Record, 520 N. Michigan Ave., Chicago 11, Ill.

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WANTED: Executive, Engineers, Designers, Draftsmen, Teachers, Salesmen. Write us if available. Cleveland Engineering Agency, 2132 East Ninth Street, Cleveland, Ohio.

POSITIONS WANTED

CIVIL ENGINEER graduate; 34 years experience; design and construction; water supply; industrial plants; power plants; hydroelectric developments. PW-15, Engineering News-Record, 330 W. 42nd St., New York 18, N. Y.

CONTRACTORS ENGINEER, graduate, 30 years wide experience building and general construction, including purchasing, estimating, expediting, negotiating. Salary $100 per week. PW-12, Engineering News-Record, 330 W. 42nd St., New York 18, N. Y.

DESIGNING ENGINEER Graduate registered age 42, thoroughly experienced in design, estimates inspection specifications for heavy structures, Railroad Highway rigid framebridges industrial buildings, etc. Available for responsible position. Part or full time. Best references. PW-956, Engineering News-Record, 330 W. 42nd St. New York 18, N. Y.

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GENERAL FOREMAN 25 years experience sewers, water lines, foundations, grading roads, heavy timber work and concrete. PW-992, Engineering News-Record, 330 W. 42nd St., New York 18, N. Y.

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(Continued on opposite page)

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